UNITED STATES ARMY JANUARY 1971

AVIATION DIGEST

CRUISE
UH-1H
T53-L-13

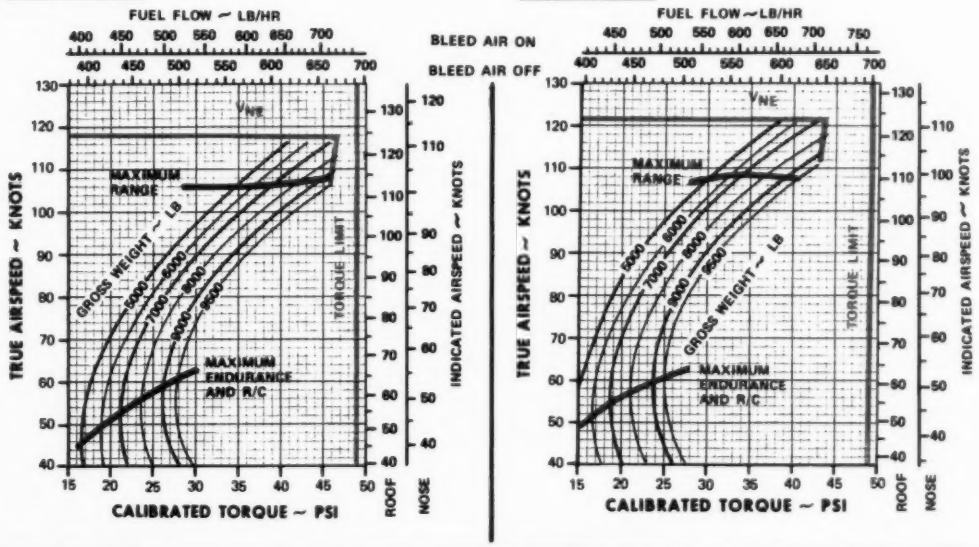
CRUISE

TM 55-1520-210-10

PRESSURE ALTITUDE 2000 FEET

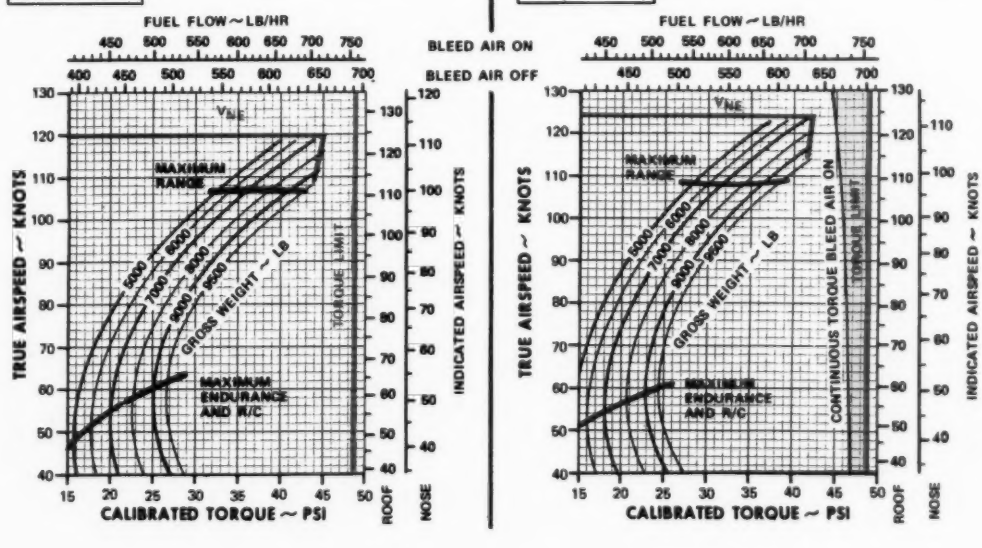
CLEAN CONFIGURATION 324 ROTOR/6600 ENGINE RPM JP-4 FUEL OGE

OAT = –20°C



OAT = 0°C

OAT = –10°C



OAT = 10°C

FUEL FLOW ~ LB/HR
450 500 550 600 650 700 750
400 450 500 550 600 650 700
TRUE AIRSPEED ~ KNOTS
INDICATED AIRSPEED ~ KNOTS
V_{NE}
MAXIMUM RANGE
GROSS WEIGHT ~ LB
5000 6000 7000 8000 9000 9500
CONTINUOUS TORQUE BLEED AIR ON
TORQUE LIMIT
MAXIMUM ENDURANCE AND R/C
CALIBRATED TORQUE ~ PSI
15 20 25 30 35 40 45 50
ROOF
NOSE

UNITED STATES ARMY AVIATION DIGEST

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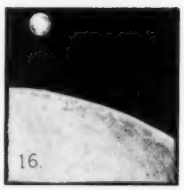

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ABOUT THE COVER

New performance data charts are on the way! However those on the covers and page 15 are test formats for the UH-1H, T-53-L13 engine and should not be used. Also, they do not contain the full color scheme appearing in the TM. See page 14 for story.

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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The Right Man

While most Army commanders would not place an amateur in a vital operations slot, many will permit a newcomer to occupy a key personnel position. This is only the beginning of a myriad of problems which confront the Army's personnel management program today

The Right Job

COMMAND AND STAFF

personnel management problems

Major Nelson L. Marsh

THE ARMY HAS gone to a great deal of trouble in providing the guidance and instruction so necessary for operating a sound personnel management program. However, certain recurrent personnel problems encountered at all command levels in the Republic of Vietnam and elsewhere throughout the Army galaxy lend credence to the theory that not everyone concerned has received "the word" on the Army's efforts.

This article seeks to impart to current and future commanders and staff officers the Army's current philosophy of personnel management, as well as to depict personnel management problems often encountered at division level and below. Proposed solutions are also advanced.

The primary objective of the Army's existing system for managing its personnel is, of course, to support the basic combat and peacetime missions of the Army. Education and training must prepare military personnel for the vital roles they may be expected to play in combat. Personal qualities which make for success in combat must be isolated, nurtured and developed. Leadership doctrines and practice must assure effective responses in the event of war.

Worldwide distribution of the Army has precluded a completely centralized personnel management system. By necessity, major responsibility for personnel management has long rested with the local commander. In the last analysis, were a completely centralized system desirious and possible, commanders would continue to take personal interest in the morale and welfare of their men to ensure effective use and direct management of the human resources available for mission accomplishment.

Career management ideally features an integrated personnel effort directed toward the progressive development of individual potential, and thereby, the employment of military members on positions commensurate with their skills, knowledge and interests. Career management programs then are long-range investments in human potential, their success dependent, however, on the participant's intention to make the Army a career.

Career management, historically an old Army concept and centrally managed at the Department of Army level, has concentrated on the development of the officer corps. The management of individual officer careers has been achieved by exercising control over personnel functions in-

cluding assignment, promotion, selection for training and education, counseling and other activities related to career development. This system has had desirable results in meeting the Army's requirement for competent officers, the individual's need for structure and guidance in career development matters.

Conversely, personnel management of enlisted personnel is accomplished through a decentralized system extending from Headquarters, Department of the Army and down to unit level. The careers of E-8 and E-9 personnel (to include command sergeants major) are managed by Office of Personnel Operations (OPO) much in the same manner as the officer corps. Central promotion of E-9s by DA was begun 1 December 1968 whereas that of E-8s occurred on 1 March 1969. Although E-7s are career managed at OPO, promotion authority for this grade remains decentralized.

Notwithstanding the strides made by DA as a result of the enlisted grade structure and management of enlisted careerists centrally administered (MECCA) study groups, personnel management remains a responsibility of field command. Based on the concept that officer personnel management is oriented toward mid- and long-range Army requirements, whereas enlisted management is geared toward the particular short-range needs of particular units, this system relies heavily on unit commanders, personnel officers and individual initiative to perform most of the career management functions necessary for enlisted members. Understandably, unit interests are parochial and individuals are viewed in terms of mission requirements of "here and now." In the final analysis, a pragmatic approach to personnel management occurs. Commanders, usually having neither the information nor the authority to carry out long-range career planning and development programs, generally assign, retrain, reclassify and promote to meet immediate requirements. The satisfaction of urgent unit needs frequently takes precedent over long-range interests either of the Army or the individual. As a result, units frequently find themselves embroiled with problems often of their own making.

Divergence Of Assignment Authority

At combat division level, the personnel management assignment picture has become clouded by the introduction of several "extra" managers. Besides the division adjutant general (through the personnel officer) performing his traditional role of personnel assignments, many Vietnam units frequently find their G-1, chief of staff, aviation

mismanagement of junior enlisted men at the unit level often results in the misuse of highly trained individuals

group commander and division commander *actively* engaged in making individual assignments (see figure 1 for an example of this in a typical command).

The division commander certainly has the inherent prerogative and authority to name whomever he pleases to effect personnel assignments within his command. However, by splitting the assignment responsibility pie into multiple fragments, a high degree of emphasis is necessarily placed on effective coordination between those making the actual assignment and the personnel requisitioning agency. The latter is usually the AG for *all* military personnel, regardless of the assignment or reassignment authority.

It is easy to deduce potential problems once the G-3 with his prioity-establishing function becomes involved and a physical separation of up to 400 miles occurs between division headquarters and the AG personnel service division. It cannot even be presupposed that the salient cast members are personnel experts or even personnel oriented. Were all to possess masters degrees in effective military personnel management, the case would still be one of "too many cooks spoiling the broth." Certainly a division commander, chief of staff or aviation group commander has enough headaches without becoming enmeshed with such minute daily details as officer and warrant officer assignments.

A solution plus an alternative are offered. The G-1 (who has an authorized major and staff sergeant major to help him) could make all E-9, field grade and aviator assignments and gain necessary coordination from the commanding general and chief of staff on command recommended slots (i.e., brigade, aviation group, division artillery, support command, battalion) as well as principal general and staff section chief appointments. This then offers the CG the flexibility he desires in approving his key personnel. All company grade, warrant officer, E-8 and below, as well as pilot assignments, would be made by the AG. This in total includes the bulk of all assignments numberwise. The G-1, with G-3 coordination, would continue to furnish the AG with assignment priorities, and the AG would continue handling personnel requisistioning for all grades. This system would be similar to that employed for many years by Headquarters, U. S. Army Europe and Seventh Army.

As an alternative the personnel management system could be aligned with that of the next higher headquarters. In the case of the Republic of Vietnam, the AG would make all assignments and requisitions, exclusive of full colonels which the G-1 would handle as the opposite number of the USARV Director of Personnel and Administration.

Either system described represents a simplified and distinct improvement over the example depicted in figure 1. Both reduce the number of actual responsible operators while recognizing the continuing need for key coordination agents. The reduction of counterparts for the next higher command would improve over-all coordination and communication between the two commands. This is especially important in negotiating with ever-expanding "command want lists" of desired individuals and key personnel nominations to fill "command recommended" or principle staff position requirements. Either proposed system, or a variation thereof, could easily be adapted for Army commands worldwide.

Personnel Amateurs Anonymous

It is extremely doubtful if a combat commander in Vietnam would name a newly arrived, first-day-in-combat officer as his G-3 or S-3 operations officer. To make such a recommendation at the Infantry, Armor or Field Artillery schools would likely evoke howls of derision punctuated by some rather colorful colloquialisms. And rightly so, for to appoint a rank amateur as an operations officer or combat battalion commander would prove fatal for many units in combat.

Faulty personnel staff work can prove as disastrous as poor operations planning and execution. However, while most commanders would not allow an amateur to function in the vital operations slot, many permit a newcomer to occupy a key G-1 or S-1 personnel billet though possessing no

A major responsibility of a personnel officer is the processing of awards and decorations

prior experience, education or training. From the positive rather than negative viewpoint, top-notch personnel management can either restructure a combat division from a mediocre to a first-class formation or completely reorganize, under fire, an already reputable command. Regrettably, relatively few combat arms officers look upon S-1 or G-1 work as desirable duty, although they would find few jobs as self-satisfying as working with large groups of people. The cornerstone of most combat arms officers revolves around troop command and operations duty. Personnel, intelligence, logistics and civil affairs positions come in a poor second.

Certainly there is no reason for a combat arms officer not to function effectively as a G-1 or an assistant G-1. Indeed, if he has served as an adjutant at a battalion or brigade, a G-1 section position is a natural progression. However, to *start out* in personnel work at a G-1 level, especially in combat, is not really a wise venture. Nevertheless, in one survey of 1,200 officers in a division in Vietnam, only 10 were found with prior personnel experience. Nine were Adjutant General Corps officers; the tenth was Medical Service Corps. An isolated example? Perhaps not. It is advised that the reader check his own command to ascertain how many officers can be found with even a basic personnel background.

What exactly marks the neophyte in the personnel business from his more experienced comrades? Initially, he will not be familiar with the basic enlisted military occupational specialty (MOS) system nor the equipment characteristics of those MOS where knowledge is an absolute requisite. Unversed in MOS codes and titles, he will not be able to analyze computer printouts effectively in order to advise his commander of command assets and needs. In addition to MOS codes, he also will not be familiar with the newly established career management fields (CMF).

Heavy casualties present another problem for the amateur personnel staff officer. The neophyte more than likely will have the tendency to become overly excited when he first encounters this situation and, as a result, he may grossly overestimate the numbers involved. An overrun on the replacement list of 100 to 500 percent is not at all uncommon. Experience will teach the novice to detect and report important net losses (dead, missing, seriously wounded, etc.) rather than gross casualty losses, as well as scour the command for necessary replacements before requesting help from Army headquarters.

Personnel management becomes a life or death situation when the personnel staff officer allows the strength of a combat battalion or cavalry squadron to drop so low as to not be able to defend itself properly, much less carry out offensive operations. The amateur is apt to get a fixation on certain units and direct that they receive a preponderance of available replacements while their sister units wither on the vine. How does he explain *that* to the commander when a low strength outfit is zapped?

Enough said, but examples of the personnel amateur number in the hundreds.

Historically, the primary mission of training and qualifying officers in personnel administration had been the responsibility of the AG Corps branch. Personnel management could be improved at unit level by AG Corps officers being assigned as adjutants to brigades and battalions. However, it has to be taken into consideration that this would deprive commanders of the ability to freely rotate officers throughout their units. Moreover, S-1 positions are needed as basic training grounds for personnel staff positions in the division and corps G-1 sections, as well as higher.

From the foregoing it can be concluded that

more career officers from the unit level should be selected to occupy unit level adjutant slots. From these officers then experienced and qualified G-1 section members could be chosen. In addition, a 1- or 2-week school at field Army, corps or division level would be recommended to provide these key officers assigned to G-1 sections with an overall brief on Army personnel philosophy, miltary personnel policies, the function of the personnel support system and the stressing of the individual's role in the system. An intensive short course also is recommended for all junior careerists at each of the Army's service schools. As an alternate solution, however, commanders might wish to assign a qualified AG Corps officer as their G-1 or at least assistant G-1. Several divisions in Vietnam have used this highly successful assignment technique.

Diversion Of Replacements

Under the ROAD (Reorganization Objective Army Divisions) concept, combat maneuver battalions are operationally attached to brigades in much the same way that divisions are attached to corps. The ROAD personnel service support concept calls for the AG and G-1 to deal directly with the maneuver battalions on personnel matters rather than through a brigade headquarters. However, in many divisions certain battalions are linked to a particular brigade on a rather semipermanent basis, usually fostered by tradition or geographical proximity. Therein lies another major problem, who belongs to whom? When a brigade commander feels strongly that certain specific maneuver battalions "belong" to his brigade, a diversion of officer, warrant officer and enlisted men is apt to transpire. While these diversions may take place between battalions, those diverted often wind up in the brigade headquarters.

If the battalions do in effect operationally belong to a brigade for extensive periods of time, as is frequently the case, then the brigade commander could be considered well within his rights to divert, despite the ROAD concept. The AG and G-1 would then require accurate feedback for these cases so that future necessary replacements could be based correctly from accurate strength data figures.

However, if the policy of the division commander is to "go ROAD" and constantly mix his maneuver elements to tailor his brigades to the mission or missions at hand, then replacement diversion on a mass scale may well create a strength accountability nightmare. Truly effective personnel management cannot be accomplished if battalions and division headquarters are unable to accurately correlate their respective personnel strength statistics. Brigades and battalions, thinking to gain more replacements by purposely reporting lower than actual strength, succeed only in hurting their sister Army units. Suffice to say, constant diversions by brigades can turn the personnel support system into personnel "manglement" rather than management.

The solution to the replacement diversion problem rests best with the division commander. Obviously if his policy precludes a siphoning off of replacements by the brigades, the described tactics will not be practiced and problems will not be incurred. It is recommended, however, that the division commander announce his policy to his subordinate commanders either personally at a command and staff conference or through the G-1. It would be well also that the CG's policy should include the assignment practices available to the commanders of the division artillery, division support command and, in airmoblile divisions, the aviation group.

More Personnel Problems

The above represents only a selected sampling of major problems encountered in command and

Career management for the Army officer corps and senior enlisted personnel is located at the Pentagon

staff personnel management. Space precludes a lengthy discussion, but four other significant widespread problem areas should be included, as well as their suggested solutions:

Inequity of distribution of promotion allocations (to grades E-4, E-5, E-6) at battalion and brigade level. Headquarters type units usually wind up with allocations which rightly belong to subordinate elements. The result is usually the lowering of morale and the increasing distrust of the personnel system. The solution is clear. Allocations should be passed onto organizations which statistically rate them Division AG or personnel officers should be asked for supplemental allocations.

Habitual overstrength of headquarters and administrative companies. Officer and enlisted strength runs from 110 percent to even 600 percent of the authorized strength. The result is a lowering of assigned strength to other divisional units, frequently bread-and-butter combat infantry, armor, artillery, engineer and cavalry units. The solution here is to trim excess fat from admin and headquarter elements, even if luxury services must be curtailed. Extra troops should be put back into combat companies where they belong.

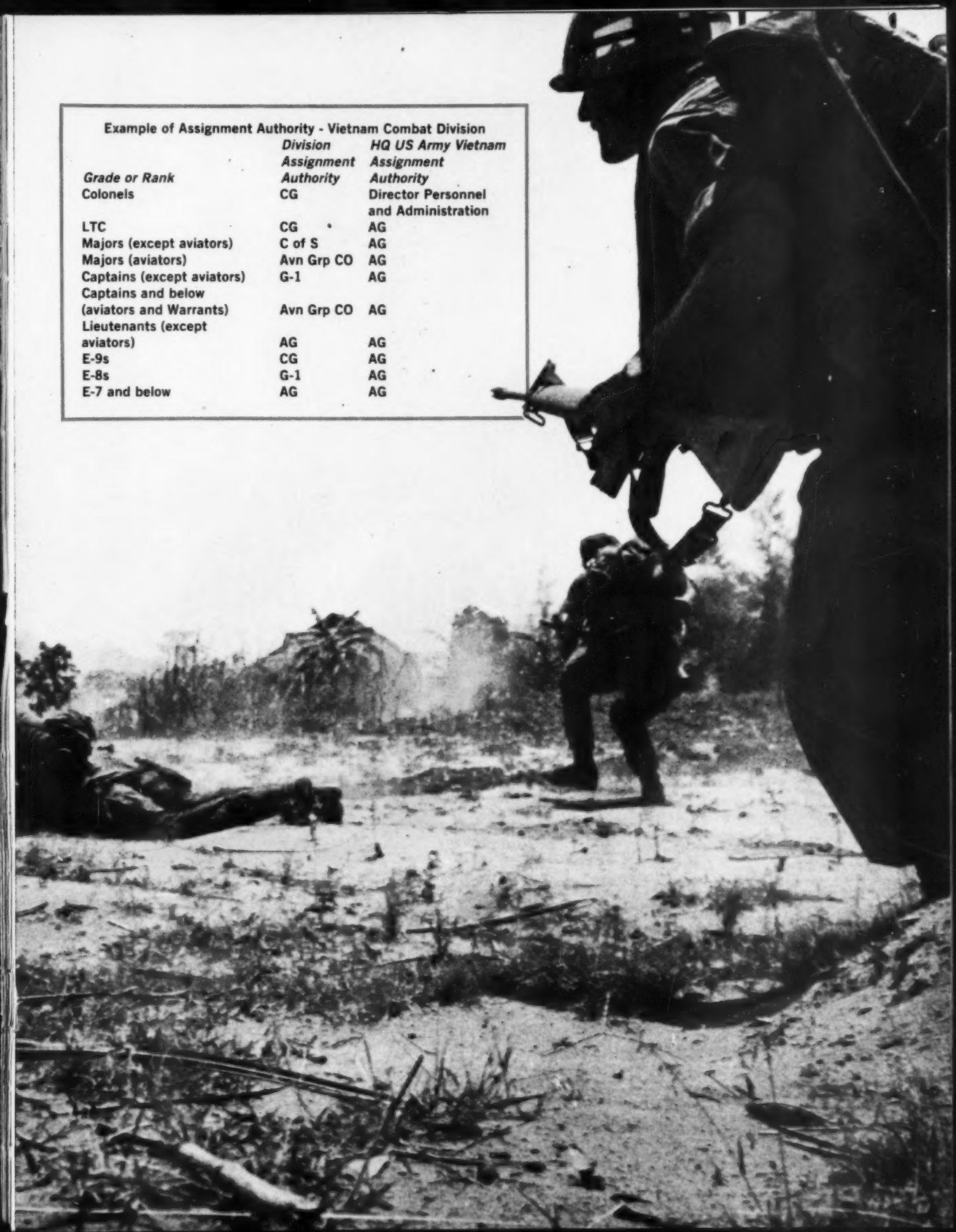
Excess use of non-TOE elements. Much troop strength (from 50 to 1,000 men) is dissipated from staffing and operating non-TOE organizations such as post exchanges, division separate forward or rear fragments, NCO academies, language schools, beach and similar nonessential recreation facilities, commander's separate messes, replacement training schools and the like. Non-TOE outfits should be closely scrutinized and their usefulness weighed against the manpower employed. Similar functioning units possibly could be combined; others could be eliminated. The result would be a net savings of a platoon to a company's worth of men returned to low strength organizations.

Overliberalization of awards and decorations. Sooner or later every American war seems to evoke a watering down of the Army's standards for awards and decorations — the Medal of Honor fortunately excepted. Men receive Silver Stars for Bronze Star "V" deeds. Commands award achievement decorations from a computer printout based on service time rather than specific accomplishment. The obvious solution is for the division commander to review his command's award and decoration policies and to tighten up where appropriate. The standards should be kept at an acceptable level so that the recipients do not feel they are getting a cheap "shot" award.

Personnel management should be approached with a judicious helping of old-fashioned common sense. Effective management application can make a mediocre unit into a top-flight group; ineffective personnel management and leadership can sap morale and lessen unit usefulness. For after all, sound personnel management and leadership should be synonymous. Unfortunately, however, this is too often not the case.

Example of Assignment Authority - Vietnam Combat Division

Grade or Rank	*Division Assignment Authority*	*HQ US Army Vietnam Assignment Authority*
Colonels	CG	Director Personnel and Administration
LTC	CG	AG
Majors (except aviators)	C of S	AG
Majors (aviators)	Avn Grp CO	AG
Captains (except aviators)	G-1	AG
Captains and below (aviators and Warrants)	Avn Grp CO	AG
Lieutenants (except aviators)	AG	AG
E-9s	CG	AG
E-8s	G-1	AG
E-7 and below	AG	AG



The new decade will see many significant changes in Army aviation equipment and the manner in which it is employed. But some human problems still loom and must be solved.

Human Factors In AIRMOBILITY 1970-1980

Dr. Wallace W. Prophet
Director of Research
HumRRO Division No. 6

DURING THE COMING decade human factors research problems involving Army aviation should be falling in three general areas:

- Problems that derive primarily from airmobile operational considerations.
- Problems that derive from or are centered in hardware considerations.
- Problems that are based in the characteristics of the human learner and the learning process itself.

Concerning airmobile operations, two problems of major concern arise — neither is new and, while headway has been made on each, neither has been solved. The first concerns our ability to operate under restricted visibility conditions. The full exercise of airmobility cannot be realized until we are able to extend the range of conditions under which we can fly.

Developments such as low-light TV may make it possible to fly aircraft, particularly helicopters, under illumination conditions not heretofore possible. However, we have hardly scratched the surface concerning the display and training requirements in this area. We know relatively little about how to teach helicopter control by reference to a TV display, particularly to the naive student pilot. This latter student represents one of the significant training challenges for Army airmobility. If large-scale night airmobile operations are to be achieved, we must be able to teach such skills to our students, rather than only to the pilot with 2,000+ hours of experience.

Another operational problem area concerning airmobile operations is low-level navigation. It is obviously related to the first, with primary emphasis on day navigation by visual reference to outside cues. The Army has evolved the concept of nap-of-the-earth flight as a means of allowing the helicopter pilot to avail himself of cover afforded by the terrain and to preserve the element of surprise. However, nap-of-the-earth navigation is one of the most demanding flight tasks that can be required of the pilot. The flight path is devious and terrain clearances are minimal. Perception and interpretation of visual cues for navigation become extremely difficult, not only because of the altered visual perspective, but also because of time compression and masking factors. At extremely low altitudes angular velocities of terrain features moving through the visual field may become so great that the pilot is unable to perceive what the features are. Also, it may be impossible to see a navigation checkpoint — a road intersection or a building — if it is as short a distance as 50 meters from the aircraft flight path.

The Army has some sophisticated electronic navigation systems under development that will assist greatly in obtaining a solution to this problem. But, a true nap-of-the-earth navigational capability will have to rely on our most sophisticated sensors and computers, the eyeballs and brains, as well as on our electronic black boxes and bugs.

The second major type of problem to be faced in the next decade is hardware-centered. In the cockpit design and instrumentation area we need an increase in emphasis on the design of equipment from the point of view of training. It sometimes seems to be forgotten in the design of an aircraft that someone will have to learn to fly it. Often the trainee is 18 to 20 years old with little or no mechanical or aviation background. Most warrant officer trainees enter the program immediately after graduating from high school. The question is not the adequacy of the cockpit design and instrumentation for the test pilot or the experienced Army pilot, but how they fit the naive student.

An example may illustrate what consideration of training in design means. In the AH-1G HueyCobra the pilot and copilot gunner are seated in tandem. The copilot gunner, who sits in the front cockpit, has rudimentary flight control that he can use to control the aircraft in the event the pilot is disabled. In teaching students to fly this aircraft, the instructor sits in the front cockpit while the student is in the rear cockpit. The point of concern is that the flight controls in the student cockpit possess a considerable mechanical advantage over those in the front cockpit. You can see what happens if the student freezes on the controls in a precarious flight situation. If the fact that students must learn to fly the aircraft had been considered during design, a different decision might have been made on this feature. This type of example can be multiplied.

Another hardware factor that is going to be more and more prominent in airmobility considerations is the proliferation of black boxes in our aircraft systems. Black boxes — computers and other marvels of electronics — are wonderful, but we must recognize and be prepared to pay the price they exact. This does not refer to their direct procurement costs, but to the maintenance costs of these sophisticated electronics systems. If we do not do the necessary planning and research for their maintenance — both for maintainability and consideration of the manpower and

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training problems for maintenance personnel — then we may find ourselves frustrated and hindered by their use.

The next research area, which will be of increasing importance to aviation training, has both a hardware and a learning orientation. This refers to the growing importance of the computer in instruction. The use of the computer in flight simulation makes it especially important to aviation training. We can now consider training techniques that were previously impossible such as those associated with synthetic flight training systems.

There is a real danger that the use of the computer in instruction can simply be a means to disseminate bad instruction to more people in a shorter time. There are those who contend that this is what has taken place with much of educational TV. However, we do not need to create still another electronic "wasteland." To utilize the computer in this fashion would be tragic. We must devote the necessary research attention to the learner and the learning process if we are to realize the true potential of our new training media. We must extend our horizons as to the capabilities of new media, rather than simply trying to tailor the media to our pre-existing educational concepts.

Turning to the last problem area, the people problems, the next decade will see the devotion of more research time to the learner as an individual. In our manpower management — recruiting, training and assignment — we are going to have to consider more carefully the numbers and kinds of learners entering the military. There will be more concern over the effects of the civilian social climate on the attitudes of the young men entering the services. It is obvious that we are in the midst of some extensive and important changes in our society. For the military psychologist and the military commander to ignore these changes would be as foolish as for the commander to ignore changes in hardware technologies or in potential enemy tactics.

Of particular concern in the aviation field are the aptitudes of our trainees. Task difficulty, electronics maintenance and the high costs of aviation training as factors of concern have already been mentioned. We need more research on selection of personnel for these complex training programs and on how best to use them. Our pool of high-aptitude personnel is not unlimited.

A related area of research during the 1970s will be the individualization of instruction. There is already a definite trend away from the rigid, lock-step approach in military training. This individualization process has both training and social implications. Training research developments such as programed instruction and computer-assisted instruction allow for much individualization, but we need to know more about factors such as perceptual style or learning style in order to tailor instruction. We need to determine the best instructional strategies for different levels and constellations of aptitudes. Thus, while we may individualize our instruction, we will still desire that the performance capabilities of our graduates meet specific, defined standards. As one of my Human Resources Research Organization (HumRRO) colleagues, Howard H. McFann, has stated: "If at some point in time you wish people to be different, then treat them the same; if you want them to be alike, then treat them differently." Dr. McFann was pointing out that instruction must recognize individual differences.

A final area of research concern for the 1970s is study of the learning process itself, particularly the learning of complex perceptual-motor skills. Good starts have been made in this area — factor analytic studies of motor skills, behavioral taxonomies, etc. — but we need a much better understanding of the fundamental process if we are to engineer behavior effectively and efficiently. This need for better understanding applies to some seemingly simple problems. For example, one of our knottiest problems in aviation is simply that of measuring performance validly and reliably. Sound measurement is a necessary step in understanding the learning process, but we have a long way to go in this area.

In summary, the Army has mounted a broad human factors research and applications program showing its clear recognition of the critical importance of the human factor. I have emphasized aspects of the program related to airmobility, but the program is aimed at all types of Army operations. We currently are doing many interesting things, but the research possibilities for the coming decade appear even more exciting.

Did you ever really want something and not know quite where to look? Do you find yourself afraid to seek outside advice for fear of exposing a certain "weakness"? Well friend, take a hint from dancer Suzanne Charny, read the following article for some straight answers to a number of basic questions . . . without risking any "exposure "

ATTENTION: National Guard and Reserve Units

Lieutenant John H. Zwarensteyn

THE WORD THESE days is streamline. The resulting action . . . reducing the size of the Active Army while increasing the strength and equipment of Army Reserve and Army National Guard units. With the introduction of new equipment to these components, present training capabilities and procedures will be taxed severely.

Be prepared for the time your Reserve or National Guard unit receives its OV-1 Mohawks, UH-1 Hueys, CH-47 Chinooks or CH-54 Flying Cranes. Ridiculous, you say? Not at all. Word is out that more and more units will be receiving these aircraft soon. Plan ahead! Why, you ask yourself? Because it is estimated that once the decision to initiate a training program is made, as much as 6 months will elapse before the actual training can begin. Therefore, this planning time becomes a definite factor to consider.

The situation isn't completely hopeless. The problem is knowing where to go for assistance.

The U. S. Army Aviation School, Ft. Rucker, Ala., maintains a "Catalog of Correspondence Courses and Instructional Materials" available to you to support your training programs. This catalog is divided into three sections: (1) correspondence courses; (2) lesson plans; and (3) programed instructional materials. Of paramount interest to you should be the lesson plans.

The Aviation School maintains lesson plans on each formal unit of instruction presented to resident students. Continually revised and updated,

these lesson plans reflect current Army aviation doctrine. Properly used, these lesson plans will enable any competent instructor to supply the same quality instruction available at the Aviation School. Sample lesson plans available include: (1) Flight Controls, OV-1; (2) Low-Level Mission Planning; and (3) Avionics.

Supporting the lesson plans are correspondence courses and programed instructional materials, designed to increase individual proficiency. These are also listed in the Aviation School's catalog.

To avail yourself and your unit of this outstanding booklet (absolutely free), send your request to:

Commandant
U. S. Army Aviation School
ATTN: ATSAV-NRI
Fort Rucker, Alabama 36360

In addition to the above mentioned instructional material, the Aviation School produces training aids to accompany each lesson plan. However, these training devices must be requisitioned from a different source than the instructional programs. Your unit will normally order these aids through your nearest Regional Training Aids Center (see figure).

For a limited time the Director of Plans, Training and Security, U. S. Army Aviation Center, Ft. Rucker, will issue USAAVNC Pamphlet No. 310-12, Index of Army Training Aids, locally fabricated by the Third U. S. Army Training Aids Center, Ft. Rucker, upon direct request from unit commanders. Send your request to:

Commanding General
U. S. Army Aviation Center
ATTN: AJRDPTS-TA
Fort Rucker, Alabama 36360

USAAVNC Pamphlet No. 310-12 is also available at your Regional Training Aids Center. It lists training aid devices and graphics, as well as correct requisitioning procedures.

Your regional center also maintains DA Pamphlet No. 108-1, Index of Army Motion Pictures and Related Audio-Visual Aids, and DA Pamphlet No. 310-12, Index and Description of Army Training Devices. These pamphlets are not geared exclusively to Reserve and National Guard units, but when special aids become necessary they can be furnished commensurate with availability of the requested item.

Be prepared to receive your new aircraft. Begin planning now. Remember, to ensure an effective training program make maximum use of all available instructional devices. The Army Aviation School stands ready to assist you.

CONARC Regional Training Aids Centers

FIRST UNITED STATES ARMY
Commanding General
First United States Army
ATTN: Training Aids Management Officer
Fort George G. Meade, Maryland 20755

Training Aids Centers
Fort Devens, Massachusetts 01433
Fort Dix, New Jersey 08640
Fort George G. Meade, Maryland 20755
Fort Knox, Kentucky 40121
Fort Lee, Virginia 23801
Camp A. P. Hill, Virginia 22427
Indiantown Gap Military Reservation, Pennsylvania 17003
Camp Drum, New York 13601
Fort Eustis, Virginia 23604

THIRD UNITED STATES ARMY
Commanding General
Third United States Army
ATTN: Training Aids Management Officer
Fort McPherson, Georgia 30330

Training Aids Centers
Fort Benning, Georgia 31905
Fort Bragg, North Carolina 28307
Fort Campbell, Kentucky 42223
Fort Jackson, South Carolina 29207
Fort McClellan, Alabama 36205
Fort Stewart, Georgia 31314
Fort Gordon, Georgia 30905
Fort Rucker, Alabama 36360
Redstone Arsenal, Alabama 35809

FOURTH UNITED STATES ARMY
Commanding General
Fourth United States Army
ATTN: Training Aids Management Officer
Fort Sam Houston, Texas 78234

Training Aids Centers
Fort Hood, Texas 76544
Fort Sill, Oklahoma 73504
Fort Bliss, Texas 79916
Fort Polk, Louisiana 71445
Fort Chaffee, Arkansas 72905
Fort Wolters, Texas 76067

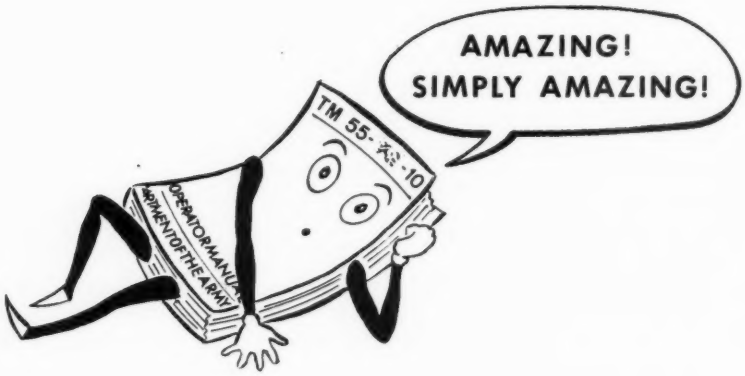
FIFTH UNITED STATES ARMY
Commanding General
Fifth United States Army
ATTN: Training Aids Management Officer
Fort Sheridan, Illinois 60037

Training Aids Centers
Fort Riley, Kansas 66442
Fort Carson, Colorado 80913
Fort Leonard Wood, Missouri 55473
Camp McCoy, Wisconsin 54656

SIXTH UNITED STATES ARMY
Commanding General
Sixth United States Army
ATTN: Training Aids Management Officer
The Presidio
San Francisco, California 94124

Training Aids Centers
Fort Ord, California 93941
Fort Lewis, Washington 98432
Fort MacArthur, California 90733
Fort Irwin, California 92310

Charlie and Danny's Write-In



To CWO G. L., CW2 J. A. L. and all you other Pitch Pullers—

We have had a few more questions on performance data charts, so this month we hope to answer all questions. The new performance data charts for the UH-1H, which we referenced recently in this column, are on the way. The old performance data charts took up approximately 131 pages in the manuals and were very seldom used. The new performance charts will take 47 pages and will give you information which will be easy to read and understand on the following items:

• *Cruise charts:* From altitudes of 2,000 to 25,000 feet with temperature range -60 degrees C. to 60 degrees C. at gross weights of 5,000 to 9,500 pounds.

• *Hover charts:* Power required to hover from 1 foot to out-of-ground effect; from sea level to 25,000 feet, temperature range -60 degrees C. to 60 degrees C. at gross weights of 5,000 to 9,500 pounds.

• *Engine performance charts:* Provide torque the engine will produce, from sea level to 25,000 feet; temperature range -60 degrees C. to 60 degrees C. at gross weights of 5,000 to 9,500 pounds.

• *Takeoff chart:* Distance required to clear obstacles from 0 to 200 feet at altitudes from sea level to 25,000 feet, temperature range -60 degrees C. to 60 degrees C. at gross weights of 5,000 to 9,500 pounds, to include a level acceleration technique, climb acceleration technique and slingload technique.

• *Drag chart:* This chart will show the additional power required for cruise with an external load from sea level to 25,000 feet, through all temperature and weight ranges.

• *Fuel flow chart:* This will give you fuel consumption at idle while sitting in a landing zone, again through all the altitudes and temperatures.

• *Climb and descent chart:* Power required for any desired rate of climb or descent, again through all the altitudes, temperatures and weights.

The figure is a sample of one chart; it's easy to read and use. It is a cruise chart based on a pressure altitude of 2,000 feet and an outside air temperature (OAT) of 10 degrees C. The new charts will be printed on a fold-out sheet and each sheet will contain all the aforementioned charts for a particular pressure altitude, i.e., 2,000 feet.

Let's say in your preplanning you computed your true air speed (TAS) to be 100 knots, your gross weight to be 9,000, and you want to know:

• Torque required to cruise at this TAS.

• What the indicated air speed (IAS) will be with a roof mounted pitot tube.

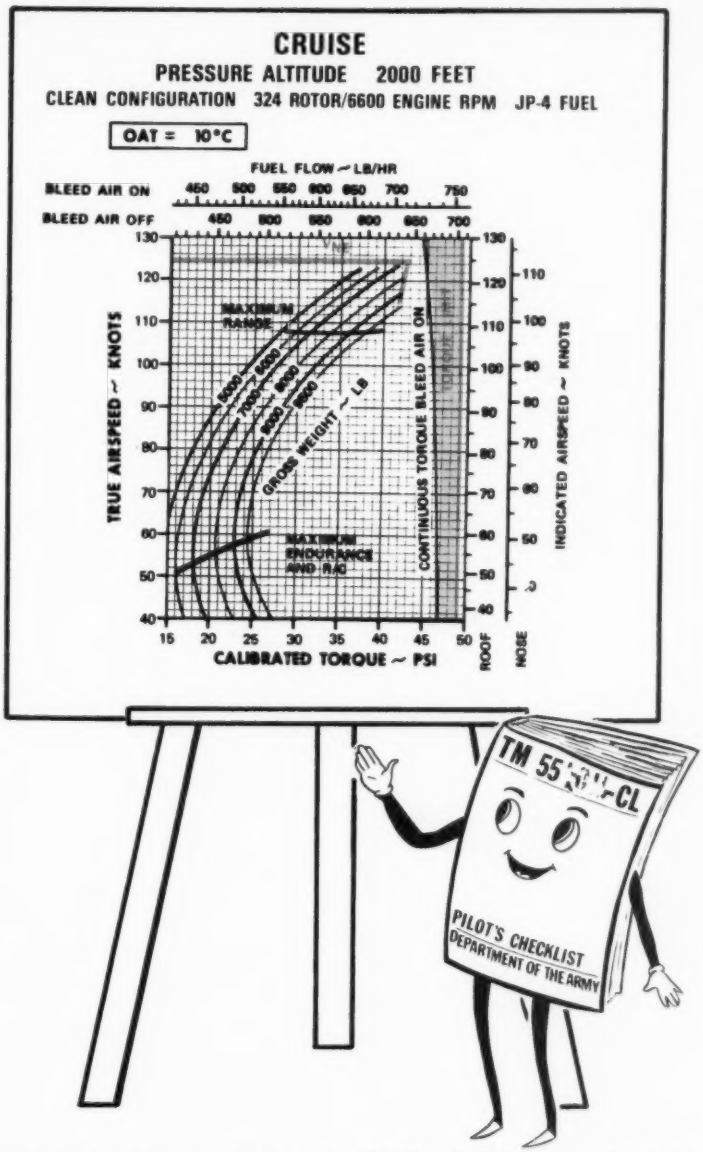
• Fuel consumption with bleed air off.

Enter the chart from the left at the 100 knot TAS line and move right until you reach the 9,000 pound line. At this point, follow the line down to the bottom of the chart until it intersects the calibrated torque line. Note that 32 psi of torque is required for this gross weight. Next, to determine your IAS go back to the original entry point of 100 knots TAS. Move to the right across the weight line to the IAS line and note your IAS will be 101 knots with the roof mounted pitot tube. To determine your fuel consumption, go back to the initial entry point and move across the chart to the right until you intersect the gross weight line. From this point move directly to the top of the chart to the fuel flow scale and note your fuel consumption will be 550 pounds per hour with bleed air off. Pretty neat, hey, all this cruise information from the chart.

Note there are two other lines on the chart; one is Maximum Range (upper middle of chart) and the other Maximum Endurance and Rate of Climb (lower left of chart). First of all, Maximum Ranges are based on a TAS of 108 knots. Move along the Maximum Range line until you come to your gross weight. Follow the line to the bottom of the chart for your calibrated torque. Again go to the Maximum Range line, follow it to your gross weight intersection, and move to the top of the chart for your fuel consumption. Follow the same procedure across the Maximum Range line to obtain your IAS. Knowing what your fuel consumption is, use your E6B computer and, based on total fuel aboard, obtain the total hours of flight time. No other TAS will give you the same range for weight factor.

The lower line is the Maximum Endurance and Rate of Climb line. Here again, go up this line until you intersect your gross weight line, follow the line to the bottom of the chart for calibrated torque. Again follow the Maximum Endurance line until it intersects the gross weight line and follow the line to the top of the chart to obtain your fuel consumption. Follow the same procedure along the Maximum Endurance line to obtain your IAS. Knowing your fuel consumption and the total fuel on board, determine the time you can loiter in the target area using the torque and air speed you have obtained.

As for rate of climb information, follow the Maximum Endurance line until you intersect your gross weight line, then go to the right to obtain IAS. This IAS is the best rate of climb air speed at a particular gross weight. The rate of climb and the torque required to give you the desired rate must be determined from the climb charts.



The charts have been subjected to a short test program at the U. S. Army Aviation School, Ft. Rucker, Ala., and modifications and improvements are currently being made. The UH-1H charts will be in the field soon and work is progressing on development of similar charts for all other helicopters and some of the fixed wing aircraft.

When you receive your charts, give them an honest workout; see how reliable and easy they are to use. Let us know what you think so we can improve them. We would also appreciate comments and questions based on this sample.

CHARLIE AND DANNY

Army Aviation 2000

THE MAN WHO has led Army aviation in its space role talks now to a distinguished group of aerospace educators at the U. S. Army Aviation School. It is the year 2000.

In looking back over the past 40 years, I am inspired and impressed by the wisdom and dedication this nation has provided the "space effort." In 1960 President John F. Kennedy issued a challenge to the space community:

> ". . . For while we cannot guarantee that we shall one day be first, we can guarantee that any failure to make this effort will make us last . . . I believe this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth."

That challenge became reality as 10 years later that historic step was taken by our first astronaut on the moon, Neil Armstrong, as he descended the steps of Apollo 11 and proclaimed to the world, "That's one small step for a man, one giant leap for mankind." One can say that giant leap placed the United States in the moon business. Today, we have a lunar colony of over 1,000 people with 420 of them being Army personnel. I will review how the Army became involved in space and, more important, the roles and missions of Army aviation. I will also briefly review some of the other branch activities to give you a broad overview for better understanding.

Apollo 11 placed a man on the moon. This feat was followed quickly by other successful Apollo missions. In 1978 the first manned orbiting laboratory was launched and a working space platform was established. Then in 1983 in the interest of international cooperation, the United Nations created a consortium to pool talent and finances for

XUM

Major Howard J. Stiles

If imagination leads to reality, then the Army aviator of the future cannot help but meet with great and ever-expanding opportunities

further space ventures. In 1985 the decision was reached to establish a lunar colony. The decision reached by the United Nations, the National Aeronautics and Space Administration and the Department of Defense was to utilize several U. S. Army personnel who were experts in the necessary fields to man the initial colony. Late in 1985 the Army Space Systems Comand was established.

Each of our 420 Army lunar explorers were trained by this command. To say the training was extensive would be an understatement. My purpose today is not to describe the workings and functions of this command. It should suffice to say they are responsible for all formal training activities, i.e., training of all lunar explorers as well as the managers needed to supervise our activities. Of course, our Army lunar explorers also receive indepth training from NASA and related government and international agencies.

The permanent lunar colony was established in 1998. Space shuttles initially carried 70 men to the moon. Simultaneously three space cargo ships carrying the lunar colony environmental equipment were launched. These pioneers erected the earth bubble, set up the solar power sources and manufactured air and water as we know them on earth. Within the earth bubble no life support equipment is necessary save a small emergency life packet worn on the hip. Today, as I mentioned earlier, that initial colony has grown from 70 to 420 Army types. The space shuttle is able to land within a mile of our lunar colony and resupply is no problem.

I think one of the most interesting lunar roles the Army has is that played by Army aviation. In 1995 a Joint Chiefs of Staff decision determined that Army aviation would operate the lunar parking orbit ship and lunar module. The Air Force space shuttle docks with the Army's orbiting parking ship and personnel are transferred to the lunar module. The lunar module crew, all veteran Army aviators, then "flies" the ship to the necessary landing zone. Cargo shuttles go direct to the moon. It is interesting to point out that

both ships recieve terminal guidance from an Army ground controlled approach (GCA) crew utilizing lasers.

How does an Army aviator become an operator of a lunar parking orbit ship or lunar module? General qualifications for selection are as follows:

- Less than 40 years of age.
- Less than 5 feet 11 inches in height.
- Excellent physical and mental condition.
- Bachelor's degree
- Certified test pilot and jet pilot.
- 1,500 hours of flying time.
- Fixed and rotary wing qualified.

Of course, those Army aviators who already were test pilots and jet qualified had an edge in the initial selection. However, lacking this qualification is not a stumbling block. We can make an Army aviator a test pilot and jet qualify him at the U. S. Army Aviation Systems Test Activity. The initial flight physical examination takes 14 days and this is the area most applicants fail.

Once this initial hurdle is over, our moon-bound Army aviators engage in long months of team training and inflight drills. This training is designed to fully integrate our man into the man-machine system. This training covers a myriad of disciplines such as:

- Mission task simulation.
- Engineering and test participation.
- Physical fitness.
- Survival training.
- Lectures and academics.

Army aviators, in addition to manning the parking ship and lunar module, are operating the lunar bug on the moon's surface. This crawler type vehicle is equipped with low level light TV and infrared sensors. In addition to exploring and traversing the moon's near surface, this machine enables our explorers to map and explore the hostile dark side of the moon.

Briefly let me touch on some of the other branches of the Army. The Transportation Corps runs the "dock" facility on the lunar surface and is charged with moving and storing all types of supplies. These transportation types also run the lunar railroad. That's right, railroad—although it doesn't run on tracks. The gondola like cars are powered by solar energy and are pulled by a large master engine car. Instead of wheels, a Caterpillar tractor type arrangement is used. These trains or individual cars are utilized within the earth bubble and for lunar caravans during exploration.

Another Army agency, the Corps of Engineers, does a tremendous amount of work on the moon. In addition to manning and running all the solar power sources and other equipment, they are establishing an experimental nuclear power plant. The Engineers also provide water through a process utilizing frozen core material from the depths of the lunar surface and solar heat.

Of course, the Engineers are engaged in detailed mapping of the lunar surface as well as monitoring the new earth mapping satellite. The Engineers in conjunction with the Chemical Corps are engaged in geological experimentation and collection of rock samples.

The Signal Corps provides continuous voice communications and TV coverage to and from earth. And, it mans several telemetry stations and monitors all the COMSAT satellites. The terminal guidance and navigation systems use laser—also a Signal Corps responsibility.

Infantry, Armor and Artillery also have teams on the moon. They are observing the exploration and assessing the lunar environment in the light of traditional land combat roles.

Last but not least are the Quartermaster people. They are charged with the responsibility for all life support equipment. They observe space suits currently in use and make repairs when necessary. They also experiment with new equipment and methods of coping with the extremes of heat and cold. The earth bubble is a dome-shaped structure which protects the colony against extremes of temperatures, as well as bombardment by ultraviolet rays and small meteorites. Our Quartermaster people are continually experimenting to upgrade our existing structure.

I didn't mean to omit or neglect the Adjutant General Corps. Of course, we have clerks and data processing personnel in our lunar colony to feed the tremendous volume of material back to earth.

This is a thumbnail sketch of the Army's role in space. This capsule summary has shown some of the important milestones of the past 40 years. I have explained the role of Army aviation. You have also learned how the many branches of the Army are contributing to the space team effort. The Army effort is but part of a team effort that is placing the free world far ahead in the exploration of outer space. Now for the next few minutes, I'll answer any questions. Thank you.

Two Distinct "Clicks"

Break your airspace, land with your gear up or fly into a mountain side and you may still walk away from it with flesh and bones intact—if you were in a Link trainer. If your instrument proficiency is low and a planned VFR flight becomes an inadvertent IFR flight when clouds suddenly envelope you, it may be too late . . . reconsider the Link trainer now

Captain William J. Ely Jr.

THERE I WAS without a copilot, one hour into my flight from Qui Nhon to Quang Ngai, Republic of Vietnam, at 2,000 feet without any visual reference. I had nearly 35 hours of "hood" time, was fairly confident that I knew the procedures involved in instrument flight and convinced that I could handle any situation that might arise. I'd had an excellent instrument instructor pilot who always praised my seemingly natural ability to fly under simulated IFR conditions.

Then, 15 minutes out of Quang Ngai, I experienced total communications failure. I tried all of the required reports that I had been taught but was unable to elicit any response. Knowing that I must be close to my destination, and because my estimates had been accurate so far, I planned for my approach. Suddenly, I noticed that my air speed seemed unusually low and I compensated with a forward movement of the cyclic while maintaining a close cross-check of all the instruments.

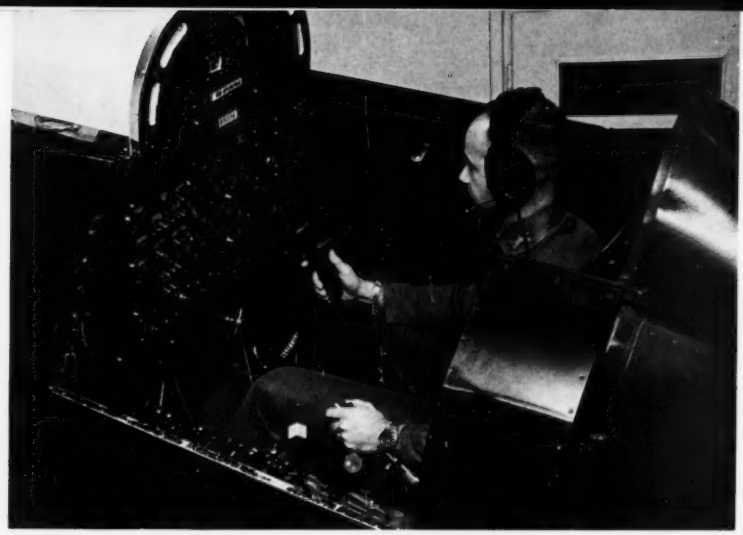
My altimeter began dropping rapidly and my natural reaction, since I had just made a cyclic change, was to add power. At this point I became somewhat panicky and must have developed a fixation on the altimeter. The attitude indicator showed 20 degrees of right bank — enough to cause my rate of descent to increase.

I knew I must be experiencing vertigo for I could have sworn that I was still straight and level. My altitude was passing through 900 feet. "Believe the instruments! Believe the instruments!" I kept hearing my instructor pilot say in the back of my mind — but things felt so normal the way they were.

The altimeter read 500 feet. I tried to move the controls to compensate, but they kept coming back to what I thought was straight and level flight. Actually, it was a steep descending turn to the right. The altimeter kept dropping — 100 feet and still no outside reference. As I passed through 25 feet I heard two distinct *clicks* — the sound a synthetic trainer makes when it falls into the straps. Stunned, and coming back to reality, I couldn't help but think what might have been the consequences if I'd actually been in an aircraft.

I know what you're thinking...he's going to tell me something about a subject that can't be anything but boring. Perhaps I can deceive you a second time. Why not take a few more minutes to finish this article and then reevaluate what might have been a misconception?

How many of us dreaded the Link, or "little blue box" as some call it, during flight school? How many of us looked at our periods with the Synthetic Trainer Branch as a waste, a required but not too profitable portion of our schooling? How many of us fully understood what actually could or can be gained from the synthetic trainer? I remember being able to set it up for straight and level flight, taking my hands off the controls and not touching them again until a course or altitude correction was necessary. Or, always using pedal for my standard rate turns instead of cyclic to achieve a more constant rate. Sound familiar? Real good training, huh? But, in the final analysis who were we fooling? Certainly not our instructor! No one except my fellow classmates took time to tell me how I could best approach my training with the Link or exactly what I should expect. As far as I was concerned it was a necessary evil toward my ultimate goal — a set of wings. But, did we ever take the time to ask what those wings represent? Let's take another look at the synthetic trainer without becoming too specific or technical and see if, after all, there is



The rotary wing Link trainer 2-B-3A is used exclusively to teach basic instrument procedures

something in it for us.

The 1-CA-1 synthetic trainer has been in existence since 1945 when it was initially designed to supplement fixed wing instrument instruction. It has subsequently been modified to lend itself equally well for helicopter training and, in conjunction with the newer 2-B-3A synthetic trainer, is used Army-wide. As the name implies, it was designed to teach and develop instrument procedures and not to simulate the flight characteristics of a particular aircraft. Although capable of performing the latter to some degree, this is not its sole intent and it does this only to make you realize that navigation is not your only responsibility — you have to fly the aircraft first. Its capabilities for teaching instrument procedures (as I'll point out later) are almost unlimited.

Why has the Army chosen to employ the synthetic trainer to supplement flight line instruction? As the expression goes, "safety first." "No accidents since inception" reads the inscription in the Link building at Hunter Army Airfield, Savannah, Ga. How true! Have you ever heard of an accident investigation board convening in a Link building? The worst that could possibly happen is a fall from the stairs as you're climbing in or out of the trainer or as was the case in the flight that I related earlier—hurt pride.

A second reason is a simple matter of economics—cost. Eight dollars an hour versus $35.25 for a 1-hour flight in a UH-1 isn't much of an argument when we are talking about 2,000 hours a month. A little basic math and we realize a monthly savings of about $54,500.

Finally, "72 degrees and clear" is always the forecast in the Link building and you just can't beat those flying conditions. How often have we wished that we had some control over the weather to preclude weekend flying during the training cycle?

The qualifications of the instructors who operate these synthetic trainers are somewhat underrated and deserve consideration. Like our present day computers, the Link is only as effective as the programer or instructor makes it. In order to qualify as an instructor, each individual must undergo an initial 11-week course of instruction to obtain the required military occupational specialty. At Hunter AAF he must then get additional local on-the-job training which may run as long as 5 or 6 weeks. He also is encouraged to attend a 3-week MOI course.

At Hunter AAF about 10 percent of the instructors also are qualified instrument ground instructors through the Federal Aviation Administration. Two instructors have type ratings in the large commercial jets and several have private and commercial ratings in smaller aircraft. Consequently, even though it may be difficult to swallow, these people holding down E-6 and E-7 positions (sometimes only E-2s and E-3s) probably know a lot more about the regulations and procedures of instrument flying than the average "you" or "me." Spot checks by organic standardization personnel and check pilots from Flight Standards Division ensure the high quality of instruction.

Now, let's talk about the capabilities of the trainer itself. With the proper modifications it is capable of duplicating any instrument situation that might occur in an aircraft. This sophisticated piece of equipment costs approximately $25,000 and more than pays for itself during its lifetime. The maintenance required in upkeep, although substantial, is by no means comparable to that which is performed on an aircraft. Hunter AAF has probably made more utilization of this training aid than any other installation due to the intense modification program that it has in effect. The maintenance personnel have added radio magnetic indicators, dummy UH-1 engine instruments, 80 knot air speed straps to replace the wooden blocks and boom mikes to replace the handheld microphones. They are currently adding magnetic compasses, dual needle radio magnetic indicators, glide slopes, manual VORs to

The "takeoff" of two fixed wing students in the GAT-2 flight simulator is being closely monitored by the instructor

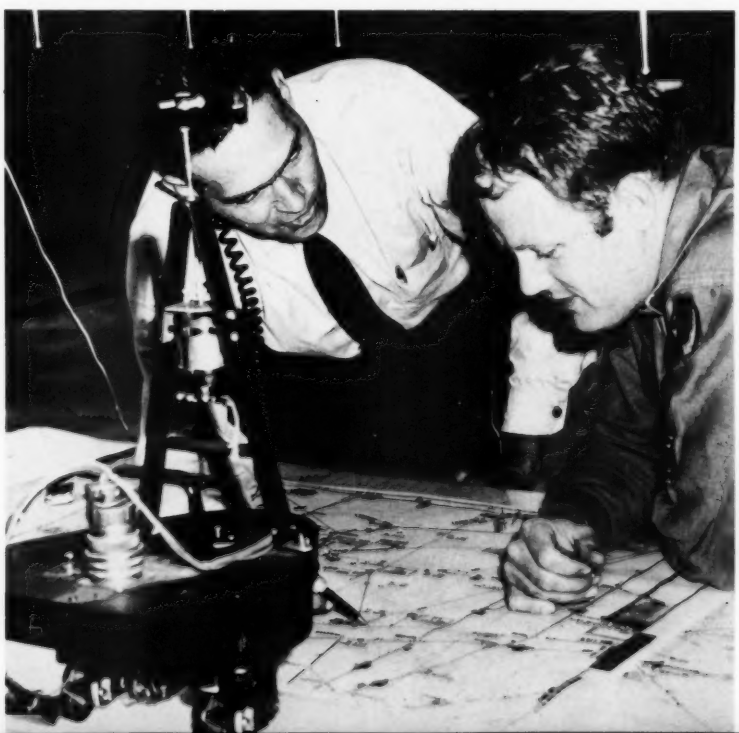
give a dual VOR capability and remote course selectors. Additionally, they are also in the process of constructing a complex vertigo simulator which, when completed, will provide the student or rated aviator with an invaluable training experience.

What does the synthetic trainer mean to you as an aviator? Exactly how professionally qualified are you? Professionalism, like safety, is a frame of mind—an attitude. Since in aviation there always has been a correlation between professionalism and life expectancy, the professional aviator learns to eliminate from his vocabulary such words as *stupidity* and *laziness*. Sure one encounters bad luck, the unforeseen, the unknown quantity for which no one can plan. But, true bad luck is distinct from stupidity or laziness.

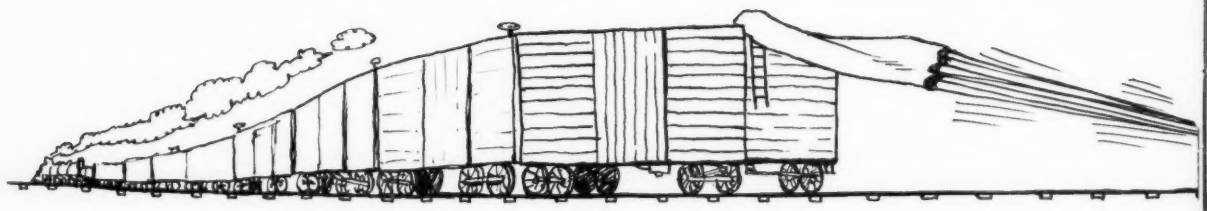
Few aviation accidents can be solely attributed to luck. Whether you are VFR or IFR qualified, there is always room for improvement. If you are a professional you're never satisfied. Do you want your tactical ticket renewed? Trying for your standard card? Exactly how proficient are you? How long has it been since you last flew on instruments? Could you pass a check ride right now?

You have to start somewhere, and this is where the synthetic trainer and the related branch can be of great help. Why not take time to brush up on the procedures of instrument flight? For example, let me give you an idea of what the Synthetic Trainer Branch at Hunter AAF has to offer its aviators. Besides conducting training for the ORWAC/WORWAC students coming through flight school (and more recently Vietnamese students), they also are offering transition training for instructor pilots conducting Allied military training. They work with rated aviators trying to renew their tactical tickets. Also, a program is in operation for pilots who were never able to get a standard instrument ticket but wish to obtain one. The synthetic trainers are open to anyone who wants to use them for any reason whatsoever, even if it's just to satisfy curiosity. So, why be satisfied? Take a little time and try to become one of the professionals everyone is talking about.

If this article has done nothing else than clear up some misconceptions that you may have had about the trainer, then I'm satisfied. If it has done more than that, why not give yourself a couple of hours and reacquaint yourself with an excellent training aid? As a result of my rather dramatic Link ride, I now approach my periods of instruction in an entirely different frame of mind. Why don't you? Besides, it's a pretty good way to help meet your minimums. AR 95-1 now authorizes you to log at least 50 percent of your annual instrument minimums in a synthetic trainer.



An instructor debriefs his student after a cross country instrument "flight"

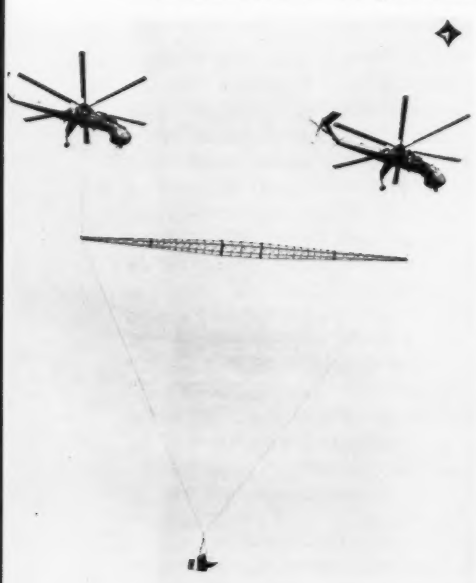


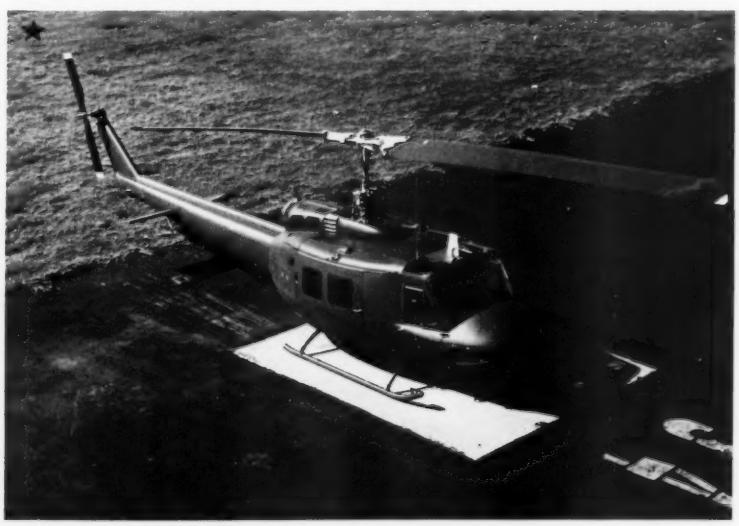
✦Tight formation flying? Well not exactly. The feasibility of the twin helicopter lift concept is presently being tested at Ft. Eustis, Va., by Sikorsky Aircraft Corporation under a contract with the U. S. Army Aviation Material Laboratories. Pictured here two CH-54B (Cranes) lift a 40,000 pound (20 ton) load suspended from a 5,000 pound steel girder called a spreader bar. The initial tests were limited to a 15 knot forward speed.

Several publications of interest to Army aviation personnel have been revised or republished recently and are available through normal distribution now. TC 1-34 (2 Sep 70) specifies requirements for aviator qualification in all Army aircraft. Change 3 to TM 1-260 (8 Sep 70) updates the manual on rotary wing flight techniques, and ASubjScd 1-2 (23 Sep 70) is a revision of the training guides in establishment and security of Army airfields and heliports.

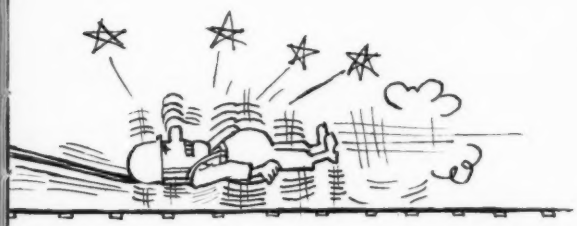
★Pictured is a prototype of the Bell 214 Huey Plus. With its 40 percent increase in lift capability the ship will be able to transport a standard 10-man squad 100 nautical miles and return without using its fuel reserve. Cruise speed is reported to be 130 knots and it boasts of improved reliability and survivability over the UH-1H.

Among the several modifications added to a strengthened H model airframe (one already proven in over 7,750,000 combat flight hours) is the stability control and augmentation system (SAS) replacing the familiar stabilizer bar. The diameter of the rotor blades has been increased by 2 feet to a total of 50 feet and the blade chord has been increased from 21 inches to 27 inches. It also incorporates the new double swept tip blades which reduce the need for power in high speed flight. It is powered by a 1900 shaft horsepower Lycoming T53 engine and an improved 2000 horsepower transmission.





TRACK STARS READ . . .



POTPOURRI

and also . . .

ST 1-100-2 Army Aviation Common Subjects has been augmented by Supplement One, Noncommissioned Officer Education System (Oct 70). Intended for use in training programs for NCOs, it provides lesson plans for use in the several service schools' basic and advanced training programs. Individuals or units desiring copies may secure them by writing: Commandant, U. S. Army Aviation School, ATTN: ATSAV-DL-L, Ft. Rucker, Ala. 36360.

ATC personnel will be interested in the ATP and ATT for TOE 1-207, ATC Company presently under revision at the U. S. Army Aviation School. The new ATP and ATT will address the golf series TOE. Air traffic control personnel who have served in units organized under 1-207E may have valid ideas about unit operations which should be taught and tested. Send your ideas on DA Form 2028 to: Commandant, U. S. Army Aviation School, ATTN: ATSAV-DL-L, Ft. Rucker, Ala. 36360.

Two new Army subject schedules, as yet unnumbered, are under preparation by the U. S. Army Aviation School. Entitled "Ordnance Delivery Systems for Army Aircraft" and "Airmobile Operations," they encompass areas of interest to all aviators.

INSTRUMENT CORNER

Q. How is the flight plan void time computed for the DD Form 175?

A. The flight plan void time is mandatory for stopover flights only. Section II, DOD FLIP states that it is the planned *total time* from initial takeoff to landing at the last destination listed on the DD Form 175. It is entered in the passenger/cargo code section of the DD Form 175. Keep in mind that AR 95-1 limits ground time to 1 hour, excluding air traffic clearance delay, on stopover flight plans. Also, don't confuse flight plan void time with weather briefing void time.

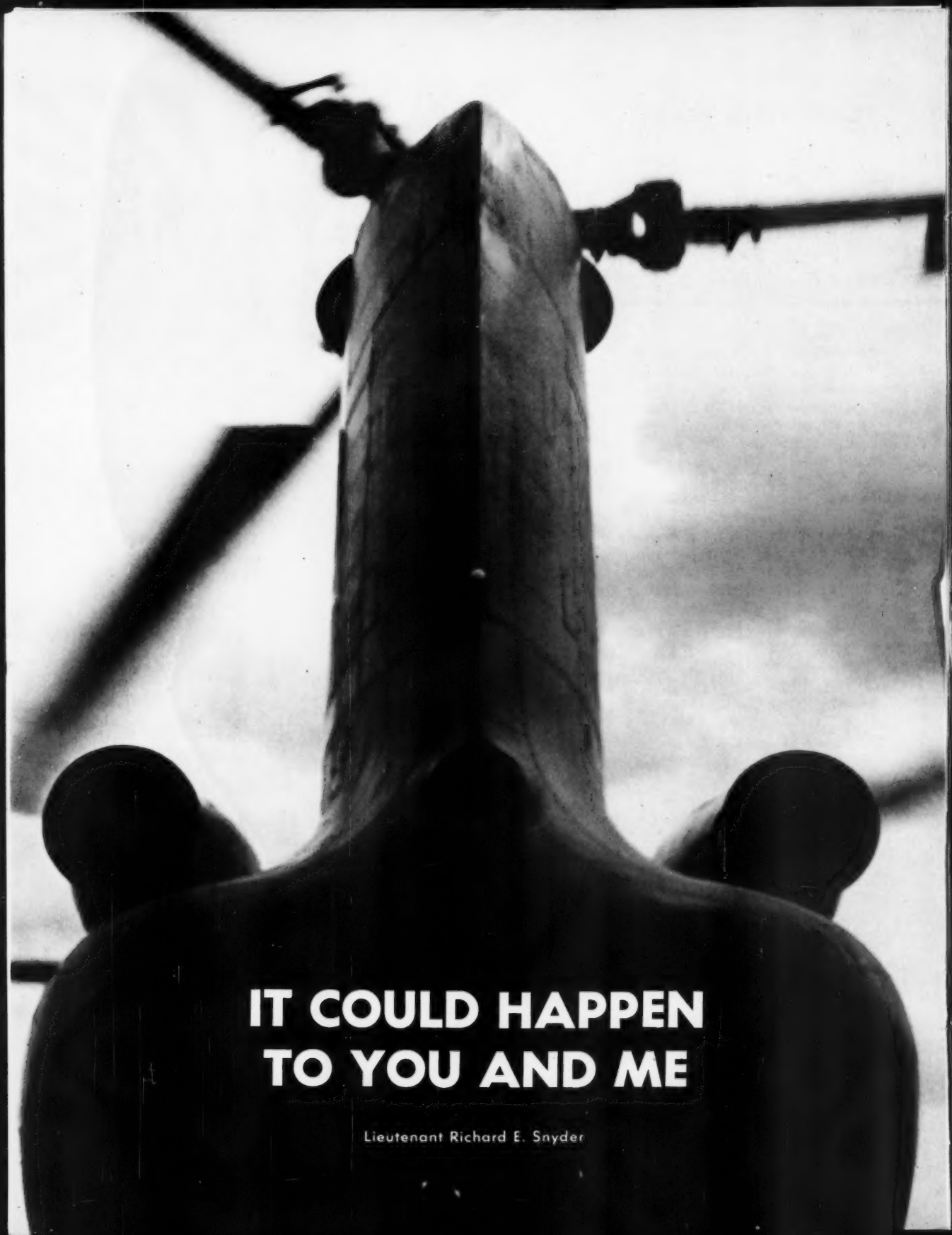
Q. What does the "X" following a communications frequency in the IFR Supplement indicate?

A. The IFR Supplement under "Radio/Navigational Data" explains that the "X" following a frequency indicates that it is not normally monitored and that the frequency can be requested through the control agency under which it is listed.

Q. In the block labeled "Type of Flight Plan" on the Military Flight Plan, DD Form 175, there are four types of flight plans shown: IFR, VFR, DVFR and FVFR. DOD FLIP Section II gives an explanation of the first three, but not the FVFR type flight plan. What is an FVFR type flight plan and how is it used?

A. An FVFR flight plan is one which the pilot files when he desires flight following services from the flight service stations along his planned route of flight. This type of flight plan is no longer utilized by the military and as the DD Form 175 is revised it will be deleted.

AR 95-2 requires VFR position reports be made once each hour whenever practicable, and DOD FLIP Section II requires reports every 200 nautical miles or each hour, whichever occurs first (below 18,000 feet MSL). As a result military aircraft receive flight following services routinely, and a special flight following type of VFR flight plan is not necessary.



IT COULD HAPPEN TO YOU AND ME

Lieutenant Richard E. Snyder

Using the checklist to make a preflight inspection is one of the surest and best methods of preventing an accident, until some other method is invented

A PINK SUN was just barely breaking over the horizon in the Republic of Vietnam as the two "Hook" pilots made their way to the revetment where the CH-47A Chinook that was to be their aircraft for the day's missions was parked. They had just completed a hurried mission briefing with the operations specialist and received a current list of VIP pads and arc lite (B-52 strike) areas.

Arrival at the helicopter found the flight engineer and crew chief busy stowing 5,000-pound tiedown straps while the gunner mounted the M-60D machine guns and checked the supply of ammo for each.

"How does she look, chief?" asked the aircraft commander (AC).

"She'll go sir, no sweat. We only have 8 hours left before the next periodic inspection," replied the flight engineer.

"That should be enough for today. Unbutton her so we can make a quick check. We only have 20 minutes before takeoff."

The preflight inspection was performed as usual with the AC checking the engines, aft pylon and rotor head while the pilot checked the forward pylon and rotor head. Ten minutes later the inspection was completed. Both pilots adjusted their seats, strapped in, set the altimeters to field elevation and put on their helmets and gloves.

"Battery is on, commo check—how do you hear in the rear?"

"Loud and clear in the rear, sir," came the reply from the flight engineer.

"Ready on the P?"

"APU clear to start, sir." The auxiliary power unit started with the familiar whine. The number two hydraulic pressure caution light went out. The AC released the auxiliary gear box switch and the number one caution light went out. The generators were turned on.

"Okay, you go ahead and run the controls through," the AC told the pilot. "I want to adjust my seat a little better."

The flight controls were run through with no unusual binding felt or excessive fluctuation of hydraulic pressures noted.

"Ready on one, chief?"

"Ready one, sir."

The pilot moved the number one engine condition lever to the ground position while the AC turned on the fuel boost pump switches, the fuel valve, the start fuel and the ignition.

The aircraft commander punched the start button, "Pressure rising, 450 EGT start fuel is off, 35 percent N1 ignition off, good start on one. Ready two?"

Number two engine was started in similar fashion. The rotor rpm built slowly. At 80 rpm, "Ready one and two to flight?"

"One and two cleared to flight, sir."

The engines surged as the aircraft commander moved the condition levers to the flight position. Both engine torque needles shot up, then stabilized. As soon as it was apparent that the engines were on line, the pilot beeped the rotor rpm to 230 and matched the torque.

"P to stop, chief."

"Clear P to stop, sir, chocks are in, ramp is up, ready in the rear."

"You take the transmission pressures and temperatures and the emergency engine beep; I'll catch the overhead panel," the AC instructed the pilot.

The entire starting and runup procedure took only 8 minutes. They were ready to go.

"Bearcat tower, Wildcat 087 on the Chinook ramp, ready for taxi."

"Roger 087, taxi for a 05 takeoff, the altimeter is 3001, the winds are 080 at 6, tower time is 28 Seiko time, call when ready."

The big aircraft moved forward as the pilot manned the controls and the AC maneuvered with the power steering.

"Bearcat, 087 holding short of the active, ready to go."

"Roger 087, you are cleared into position, cleared for takeoff. Have a nice flight, sir, and we'll see you this evening."

The AC used the steering to taxi into position and locked the swivels. The pilot slowly increased the thrust and the aircraft became airborne. The AC checked the transmission pressures and temperatures as the pilot re-established 230 rpm and matched the torque.

The AC noted the time was 0630; they had just made it at the prescribed time. He lit a cigarette and relaxed; it would be a pleasant 20-minute flight to Quan Loi where he hoped their first load was rigged and waiting.

"Take it to 4,000 feet," instructed the AC as he adjusted the V_{ne} computer. "Let's hold 110 knots."

"Roger that," answered the pilot.

Upon arrival at Quan Loi, contact was made with the fire support element (FSE) controller. They were informed that their first load would be five

The importance of adhering to checklist procedures during the initial hookup (left) and the final load release (right) in an external load operation cannot be overemphasized

passengers and an external load of 8,000 pounds. Class V to Landing Zone (LZ) Rita for the White Knight element.

The pilot made the approach and landed to pick up the passengers. He then hovered over the load for a hookup. The load hooked, he began his takeoff while the AC cleared with Quan Loi tower. The pilot again set the rotor rpm at 230 and matched the torque. They climbed to 3,000 feet and picked up a 240-degree heading. A beautiful day thought the AC—smooth air, small cumulus clouds overhead and the sun now shining bright and clear. A good day for flying. Well, only 3 months and it's back to the world for me.

Twenty minutes later they arrived at the LZ.

"Rita, this is Wildcat 087,. three northeast for landing. Class V for White Knight."

"Roger, Wildcat 087, make a northerly approach to the log (logistics) pad and be advised that we have a report of small arms fire in the southwestern sector, possible automatic weapons."

"087, roger that, with 94 days left you know I'll steer clear."

The pilot lowered the thrust to begin his approach. He established a 1,000 foot-per-minute descent while the AC armed the cargo hook. Everything looked good as they turned final.

"Okay crew, let's be on the lookout. They have a report of ground fire in the area."

"No sweat, sir, I've got you covered on this side," replied the gunner.

Suddenly at 1,200 feet the pilot's windshield exploded, bullets ripped through the fuselage to the rear of the crew chief.

"I'm hit, I can't see!" screamed the pilot.

The AC grabbed the controls, "I have it!" he shouted.

"It's yours . . . I can't see . . . I think I'm hit in the left arm too!"

The aircraft commander elected to continue the approach to the LZ since his pilot was wounded and he did not know how badly the aircraft was damaged.

"Hold your fire, gunners, hold your fire! There are supposed to be friendlies somewhere out there."

At 100 feet the AC began a deceleration and increased the thrust to break their rate of descent. The rotor rpm began to drop. He shoved the beep button forward but there was no response from the engines. The rpm continued to drop. Assuming that he had lost normal beep he quickly changed hands on the cyclic and hit the emergency engine trim switches with his right hand. The rpm increased but as he released the switches it dropped again, only lower now.

By this time they were only a few feet off the ground. The AC forgot the rpm. The important thing was to get rid of the external load. He punched the cargo hook release button on the cyclic. The hook opened just as the load touched the ground but the aircraft was still moving forward so the sling did not drop off. Instead it snapped tight pulling the nose of the aircraft down and dragging the load.

The forward landing gear made contact with the ground as the belly of the aircraft crashed into the load. The right forward landing gear strut broke off and the aircraft crashed on the right nose and fuel pod, allowing the forward rotor blades to strike the barbed wire fence surrounding the LZ and the ground.

The AC jerked the engine condition levers to the stop position and jettisoned his emergency exit door.

"Get out, everyone get out in a hurry!" he shouted.

He turned off the battery switch, unfastened his seat belt and jumped clear of the aircraft. He then ran around the nose of the aircraft and jettisoned the pilot's door. As he was helping the pilot from his seat he noticed the gunner helping two of the passengers out of the cabin door and the flight engineer dragging another. The crew chief and remaining passengers were running to a nearby bunker.

The result of the aircraft's last 30 seconds of flight and the ensuing crash was: the pilot

wounded by ground fire in the left arm and blinded by flying plexiglass, one passenger seriously injured, two other passengers and the flight engineer received minor injuries and the aircraft was badly damaged. All except the pilot's wounds were as a result of the crash. Luckily the aircraft did not burn although the right fuel tank was ruptured.

Also luckily, this story never happened. It is fictitious. But it could happen and it does happen every day somewhere in Army aviation's wide area of operations. It could very well happen to you and the really sad part is that it shouldn't.

The aircraft commander of our story had no control over the enemy ground fire that wounded his pilot, but he could have prevented the crash that followed. But how; what went wrong? Where did he make a mistake?

We have to go back to the crew's preflight and cockpit procedure to find out. Actually we have to go back even further to the time the pilots arrived at the aircraft, but preflight time versus takeoff time is a command responsibility so we won't concern ourselves with that.

What we will concern ourselves with is the crew's cockpit procedure. Aside from failing to make many prescribed checks, preflight included, the single most important item they missed and the one that was the major cause of the crash was failure to check the copilot's beep trim switches. That was the seat from which the aircraft commander was flying that day. The copilot's beep trim switches were inoperative. In addition, the aircraft commander failed to follow the proper emergency procedure prescribed for loss of A.C. beep. Prior to attempting to regain lost rotor rpm with the emergency engine beep, he should have pulled the A.C. engine trim circuit breakers.

The crash could have been avoided if the crew had used TM 55-1520-209-10CL, the checklist. It details preflight inspection procedures, cockpit procedures, pretakeoff and landing procedures, emergency procedures and performance charts. In addition, it normally comes with a handy binder, TM 1500-1. In short, it contains a wealth of information. It's small, easy to carry and printed in black-and-white, easy-to-read English. But it must be used to be of value.

Many people spend hours of research, practice and discussion on the checklists. There is a checklist printed for each aircraft in the Army's inventory. All changes to a checklist must go through many agencies so that they receive honest evaluation. In addition, the Army spends millions of dollars printing and distributing the checklist every year. That's money withheld from paychecks each month unless a person is lucky enough, or unlucky enough, to be in a combat zone. If, however, one feels something is incorrect in a checklist or he has a better, more practical method of performing a check, he needs only to submit a DA Form 2028 with the ideas. It will receive an evaluation and very possibly be incorporated into the next checklist or change that is printed.

Let's avoid accidents like the one involving the $1½ million aircraft and crew. Use the checklist—until something better is invented.

Maintenance

Oil Sampling: Whenever you take an oil sample, make it a practice to do it within 15 minutes after shutdown with the oil at normal operating temperature. This ensures a complete sample with all impurities for the oil analysis.

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Maintenance Stands: When using maintenance stands, ensure that all locks and safety devices are in place and functional.

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Groundhandling Wheel Installation: UH-1B, D and H model groundhandling wheels may be interchanged; however, on the D and H models the spring-loaded pin must be forward. On the B model the spring-loaded pin must be to the rear.

☆ ☆ ☆

Checking The Exhaust Gas Temperature System On The UH-1: At organizational maintenance this is done by using a multimeter, AN/PSM6B and an ohmmeter, WV77E. The chart on values and procedures is contained in the current TM 55-1520-210-20. Check your aircraft's EGT system today.

☆ ☆ ☆

Batteries: Hey, you UH-1D/H mechanics and crew chiefs! Besides checking for security of installation, the *only* maintenance, servicing or inspection authorized at organization level is a simple check for battery condition. Allow enough time for battery to recharge after starting engine (about 15 minutes). Take an accurate reading on the loadmeter and move battery switch to the OFF position. If the change on the loadmeter is 5 amps or less (about one needle width), the battery is good. If the change is more than 5 amps, it's a job for your battery shop.

☆ ☆ ☆

File Talk: Are you getting the most from the hand files in your toolbox? Many mechanics fail to realize that a hand file is a delicate cutting tool. All those little teeth are precision sharp cutting edges. To get the necessary hardness that is needed to cut steel, the teeth have to be made very brittle, thus they break easily from shock loads. When the file is allowed to rust, the first areas attacked are the points of the teeth. So keep your files incased and well oiled for long life. While using the file keep chips cleaned out of the teeth for fast, smooth cuts. Be sure to use a handle for good control and to avoid the possibility of injury.

☆ ☆ ☆

0-480 Engine: Sudden acceleration and deceleration of the 0-480 engine can impose excessive loads on the supercharger gear train and can produce excessive engine pressures and detonation even with the propeller in low pitch. Acceleration and deceleration can be accomplished rapidly provided that it is smooth and steady with no sudden or jerky movements.

☆ ☆ ☆

U-8 Aircraft: Contrary to popular belief, the purpose of the band of red paint on the landing gear strut on the U-8 aircraft is not to indicate "bottoming-out" on hard landings, but is to prevent corrosion on the portion of the strut which is not chrome plated. This band must be painted to protect the metal; red tape is unsuitable.

☆ ☆ ☆

T-42 Fuel System Caution: *Do not insert fuel nozzle more than 3 inches into tanks.* This information should be stenciled in an area immediately adjacent to each fuel filler cap.

☆ ☆ ☆

T-42 Electrical System: *Turn off all electrical switches before plugging in an auxiliary power unit.* This information should be stenciled in an area adjacent to the auxiliary power unit receptacle. Reference Change #1 to the operator's manual.

☆ ☆ ☆

Adjustmentnt Of Propeller Blade Angle, U-21 Aircraft: TM 55-1510-209-20 outlines procedures for adjusting propeller blade angle in the high pitch position, stating that blade clamps should be loosened and blades turned until blades are at the proper angle. This procedure will cause the blade angle to be out of ad-

Matters...

. . . when torquing bolts

justment at the full reverse and low pitch positions. Correct procedures are contained in the dash 35 and should be followed. The dash 20 will be changed in the near future to delete procedures for adjusting blade angles.

☆ ☆ ☆

Loadmeters U-21 Aircraft: Paragraph 12-248 (Loadmeters) of the dash 20 on the U-21 aircraft which states that the volt loadmeters indicate respective generator output voltage is incorrect. The wiring diagrams and continuity checks on the aircraft prove that each volt loadmeter will indicate voltage directly from the main bus.

☆ ☆ ☆

OV-1 Aircraft: All OV-1 aircraft are now equipped with the MD-2 oxygen regulators. Thus, the statement on page 6-20 of TM 55-1510-204-10/4 that the oxygen supply switch must remain on except when necessary for ground maintenance is erroneous. With the MD-1 regulator the switch must remain on; however, with the MD-2 regulator the switch must remain off unless oxygen is needed.

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Calibration Of Torque Wrenches: Be sure to check calibration date on torque wrenches before use and back off torque wrench to zero torque after use to keep tension off spring.

☆ ☆ ☆

Cleaning Of Heli-Coil Insert Threads On 0-1: Clean heli-coil insert threads with a wire brush in conjunction with a power tool. Never clean heli-coil inserts with a tap for permanent damage often will result.

☆ ☆ ☆

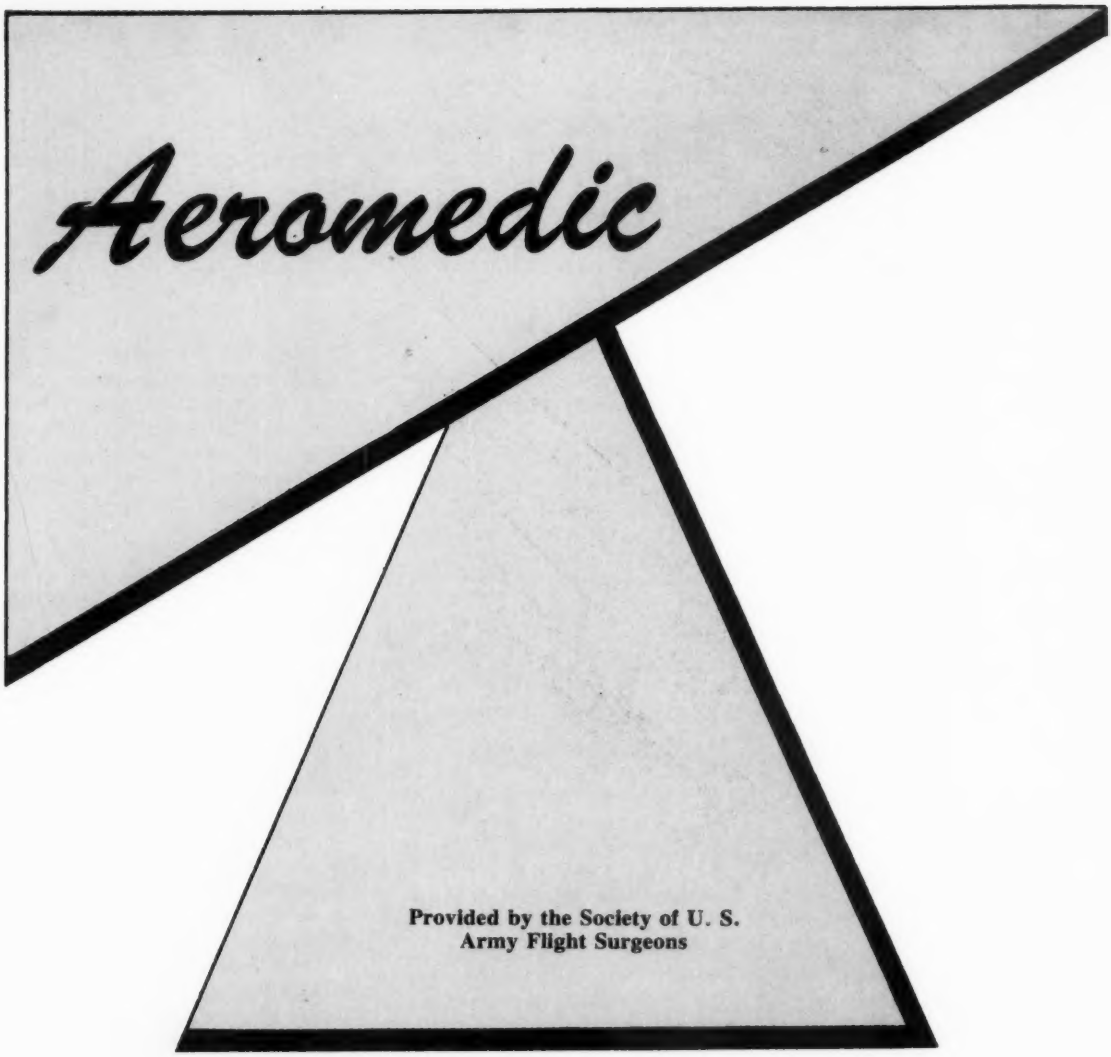
Keep Those Switches Straight: Since cold weather and icing conditions are here, remember that to activate the wing and tail de-ice boots on the 67-68 OV-1C aircraft the *systems air supply switch* must be open.

☆ ☆ ☆

Chafing Of OV-1 Hydraulic Lines: Several inquiries have been received regarding the U. S. Army Aviation School's (USAAVNS) experience with hydraulic line chafing problems on OV-1 aircraft. Page Aircraft Maintenance, Incorporated (PAMI) reports frequent chafing of the following hydraulic lines in the leading edge of the wing between the engine nacelles and fuselage:

- The pressure in line to the main filter chafing at the clamps.
- Pump pressure line from engine pumps chafing at clamps.

PAMI personnel reported this chafing was common to both left and right installations and at approximately the same place where metal clamps are attached to metal lines. The fix at USAAVNS is to replace the present clamps with Teflon-lined clamps or use ¼-inch plastic lacing material in lieu of clamps.



Major Nicholas E. Barreca, M.D.

WEAR 'EM AND WEAR 'EM RIGHT

To the air crewman: Probably one of the most treasured items in your wardrobe of protective equipment is the recently acquired, two-piece Nomex flight suit. It retards flame better than anything we've had. So wear it, *and wear it right.*

How do you "wear 'em right" you say? By having them cover as much of the maximum surface of your body as possible. This can be accomplished in several ways *when flying:*

- Keep the shirt tucked way down in the pants by keeping the belt and adjusting tabs properly fitted. Don't allow it to untuck.
- Keep the shirt zipper closed all the way up and covered by the overlapping Nomex.
- Keep the sleeves rolled down and tightly closed by the Velcro tabs. Ensure that your sleeves are long enough when you are first fitted.
- Keep the trouser fly zipped all the way up. Don't allow it to drift down and open, and thereby avoid a painful and unusual 1 percent body burn.
- Keep the trouser legs bloused and secured tightly by the Velcro tabs. Do not blouse the trouser legs with blousing garters and such. The main thing is to ensure that they do not ride up. Get them long enough to begin with.

Some units vary the wear of the two-piece Nomex flight suit during nonflying periods. This is their right so long as it does not interfere with its proper wear to provide maximum protection *during* flight.

Although Nomex fabric is relatively resistant to wear, it must still be treated with care. One should be especially alert for areas that begin to fray or wear. This can lead to thinning or breakdown of the fabric and result in decreased fire protection. One should be especially alert for such wear when blousing trousers in boots. The material begins to fray where it contacts the boot top.

Our next consideration is that of the Nomex sleeves. Commanders being concerned with comfort frequently order the sleeves rolled up during nonflying periods. Usually they reason that the sleeves are uncomfortable and place an unnecessary heat burden on the individual. But the same individual must remember to roll his sleeves down before flight or he could suffer the undesirable consequences of a really intense heat burden.

A recent ground maintenance accident involving a CH-47 Chinook resulted in fatal burn injuries to an air crewman. He had removed the upper portion of his two-piece Nomex flight suit due to being uncomfortable from the high summer heat. Certainly all air crewmen and ground support personnel should keep their Nomex shirts on and their sleeves rolled down during this type of operation.

Enough said! Regardless of how you must wear your two-piece Nomex away from the flight line, wear 'em and wear 'em right when you get to the flight line and in flight.

To the flight surgeon: The second generation, flame protective flight suit is in the planning and evaluation stages. A material named polybenzimidazole (PBI) seems to have the best characteristics. It is comfortable and will have acceptable strength and wear characteristics. Most importantly, it has more superior fire retardant properties than is currently available. In one study it was shown to protect a manikin in a standard fire test (JP-4 fuel fire for a 3 second duration, moving through the fire at 10 feet per second) 30 percent more than Nomex (polyamide). Many military agencies are pressing for this to be a one-piece version, perhaps to be available in the 1973 to 1975 time frame.

You must advise your commanders and air crewmen about the proper wear of flight clothing. Without your professional advice they will be left to their own devices and imagination, which may reflect time honored, traditional, yet medically unsound reasoning. It is your responsibility to bring these things to their attention, even when not called upon for an opinion. That's what aviation medicine is all about. In its preventive aspects, we must promote conditions in the air crewman and his environment that will decrease the likelihood of disease or infirmity.

TOUCHDOWN!

teamwork makes it . . . on the gridiron and in combat

Lieutenant Gilbert W. Acheson

AS AN AIR cavalry member in the Republic of Vietnam my job was reconnaissance. My unit was a good one and I was proud of its performance. But the mission we were destined for this night was to increase this pride still further.

Our team of UH-1C gunships erased the evening quiet with the intermittent popping of rotor blades as we were on final approach to Camp Enari in the Central Highlands. On shutdown we gave our birds a good postflight inspection and set up the cockpits for a rapid start in the event of a scramble for emergency missions. We were on scramble alert which meant we would launch in the event anyone needed gunship support during the night.

We had gone to the club to watch a movie after gulping down some cold cuts from the field mess. A field phone at the club provided a hot line to flight operations in case the first standby gun team had to be scrambled. Looking around the club I saw the pilots in our troop, but as usual the gun pilots, the slick pilots and the scout pilots were standing around in their groups.

The aircraft an Army aviator flies is a way of life and once accepted into the social group of a gun, slick or scout you're in permanently.

We were late getting to the movie and had barely settled in our chairs when the call came: "Scramble!" There was a long range reconnaissance patrol (LRRP) in heavy enemy contact north of Plei Djerang. No coordinates were needed as we had covered the slicks who had inserted the force earlier the same day. Our group was airborne in less than 2 minutes.

As I called for takeoff I heard the slicks calling also. It was one of those missions where everyone does his part as a well trained team.

Making a right break after takeoff, I heard the voice of Shamrock 6 calling for takeoff.

Our commander, having an uncanny sense for knowing which missions required his presence, would act as command and control (C&C) and also crash recovery since his aircraft had a rescue hoist. As the mission was near the Cambodian border, far from the nearest friendly position, I'm sure he realized we were all a little more

TOUCHDOWN!

at ease with his aircraft on station.

About 10 minutes out of home plate, enroute to the contact area, we called back for the second gun team to crank and report on station for reserve.

There were three slicks—two were loaded with flares, the third was the all-important pickup aircraft—one ship more than normal for a mission this far from base. Add to these a light team of guns enroute and a light team cranking plus our C&C ship and you have a total of eight, each with a specific job.

Locating the embattled team was easy once we were on station. The familiar red tracers marked the area well. Next the flare ship arrived and lit the dark night.

We established the location of the friendlies, got an adjustment from their position to the enemy and began our firing runs. Charlie was his usual sly self—he wouldn't shoot at us while inbound but waited until after we broke and were unable to pinpoint his location.

Shamrock 6's voice dominated the radio with a call to our wing ship, "Left 50, add 100."

One correction was all we needed. Our wing ship sufficiently neutralized the target to allow the slick into the pickup zone (PZ). The pickup ship was on 1 mile final for the very small one-ship PZ.

The gunships were busy pounding both sides of the prospective PZ, keeping the enemy's head down for the rescue. Suddenly the flare ship had a flare ignite *inside* the aircraft. The night turned very black indeed.

The aircraft commander of the damaged slick called our "6" and briefly explained the situation, but even as he talked the reserve flare ship kicked out a flare. The damaged flare ship orbited to the south, reassuring us that he was okay. He decided to await the completion of the mission before returning to base.

As the pickup slick came close to the PZ, we changed our ordnance from rockets and door guns to 40 mm cannon fire. The steady *krumph, krumph* of the cannon kept the pickup aircraft protected into the PZ. I couldn't help getting a chill thinking what would happen if the 40 Mike-Mike quit, allowing Charlie to raise his head.

The 40 mm kept putting out but the radios were silent. Finally the radio crackled, "I'm coming out." The slick was on its way out but was receiving fire.

Our 40 mm was running low on ammo, so we alerted the second gun team which was waiting just outside our racetrack pattern. They set up similar racetrack patterns paralleling ours with opposite direction of breaks, waiting for the call that we were expended.

The slick seemed to take hours gaining translational lift. It was now receiving intense fire from its 3 o'clock position; the second gun team immediately launched rockets on the right side of the PZ. This rocket fire quieted the AK-47s. Our aircraft grew silent as we became expended and broke off to orbit, out of the way of the gun team now engaging the enemy.

By the light of the flares you could see the pickup ship darting low level to minimize enemy hits. About a half mile from the PZ the slick aircraft commander climbed to altitude and gave our "6" a report on his aircraft and people aboard. He then turned east toward the 71st Evacuation Hospital, about a 20-minute flight.

The second gun team continued engaging the enemy and return fire lessened. When all ordnance had been expended we regrouped for the return. As the last flare burned out we knew our "6" was evaluating the terrain to enable us to find the North Vietnamese who had pinned down the LRRPs.

We would not begin our search until dawn when we could fight Charlie on our own terms. Then the light scouts would be able to locate the remains of the elements which we had engaged this eventful night. For now we must return to the base to stand by for any other missions.

As the dimmed runway lights of Camp Enari came into sight on the horizon, our commander came over the radio, "All Shamrock elements, this is Shamrock 6, well done."

All Shamrock elements didn't pertain to slicks, guns, pilots, door gunners or crew chiefs. It meant *all* elements, the team.

SUPPORT YOUR LOCAL GCA

Captain Robert R. Gamber Jr.

IT HAD STOPPED raining and the thin clouds still hanging on the top of the hill were an indication that weather would be worse at a higher altitude. The weather detachment's latest information indicated a ceiling of 500 feet broken and 6,000 feet overcast. The 11th Light Infantry Brigade tactical operations center (TOC) had been advised of the weather conditions and it was assumed that we would not be flying this night.

It was 2400 hours when the phone rang in the *Shark* hootch. That late at night it could only mean that despite the weather a mission had come through. I collected my flight gear and hurried to operations for the mission briefing.

The duty officer gave me the mission sheet with the coordinates, frequency and call sign. He said that Fire Support Base Amy, 18 miles northwest of Duc Pho in the Republic of Vietnam, was under mortar and ground attack, and the brigade wanted us to try to get through to them. Ground controlled approach (GCA) had been alerted and would be operational by the time we lifted off.

When I reached the flight line the two Charlie model Hueys making up the light fire team were being run up. GCA (not waiting for us to call) contacted us before we had a confirmed checkfire from the artillery. The gun team lifted off when the checkfire was obtained and GCA began giving us headings for our flight through the mountains.

The voice of the controller was calm and very reassuring as he skillfully guided us around the heaviest weather to our enroute altitude of 5,000 feet. There was no moon and we were enveloped in total darkness and forced to fly instruments because of the absence of a visual horizon. There were few identifiable checkpoints before we reached the mountains, and none once we entered them. GCA gave us constant heading corrections to guide us and keep our aircraft well separated.

After 25 minutes of constant course corrections the controller informed us that we were over Amy and could start a descent. I radioed the controller that we had established contact with the TOC at Amy which reported that they could hear but could not see us. So, GCA took us down until we established visual contact.

The controller held my wingman at 5,000 feet and started me into a descending left-hand turn. After turning 270 degrees Amy suddenly appeared below my aircraft. I informed the controller that I had Amy in sight and he brought my wingman down to join me. Thankful to be back in a VFR flight again, we were able to finally begin our air support mission.

We had almost expended our ordnance when the GCA controller requested we expedite the mission because the weather was getting worse. We were soon released by the ground commander and I radioed the controller we were climbing out. He picked us up and began the difficult task of returning us to Duc Pho—continually giving us course corrections to keep us clear of the weather, as he had done on the flight outbound.

Soon we saw the welcome sight of lights at Bronco. I contacted the controller to inform him we had Bronco in sight and thanked him for his efficient support. He told me he would stay with us until we were safely on the ground.

The mission described was not unique or even unusual but merely an illustration of the outstanding support that aviators receive from these faceless voices. This mission and many others could not have been accomplished or would have been a great deal more difficult without the assistance of the GCA controllers.

In this particular case the hours that the controllers spent working with an interested aviator and plotting the positions of all fire support bases and landing zones on an acetate overlay for the radar screen paid off. Without this aid the mission probably would have failed. We could not have found Amy, and, in addition, without the controller's assistance the weather would most likely have turned us back.

The dedication and somewhat rabid efforts of the GCA controllers to safeguard aviators too often goes unnoticed by those of us who fly. Remember, both you as an aviator and the GCA controller need practice. Take that extra 10 minutes and request a practice GCA—it's mutually beneficial. Please, support your local GCA—and yourself.

ARMY MIDAIR COLLISIONS

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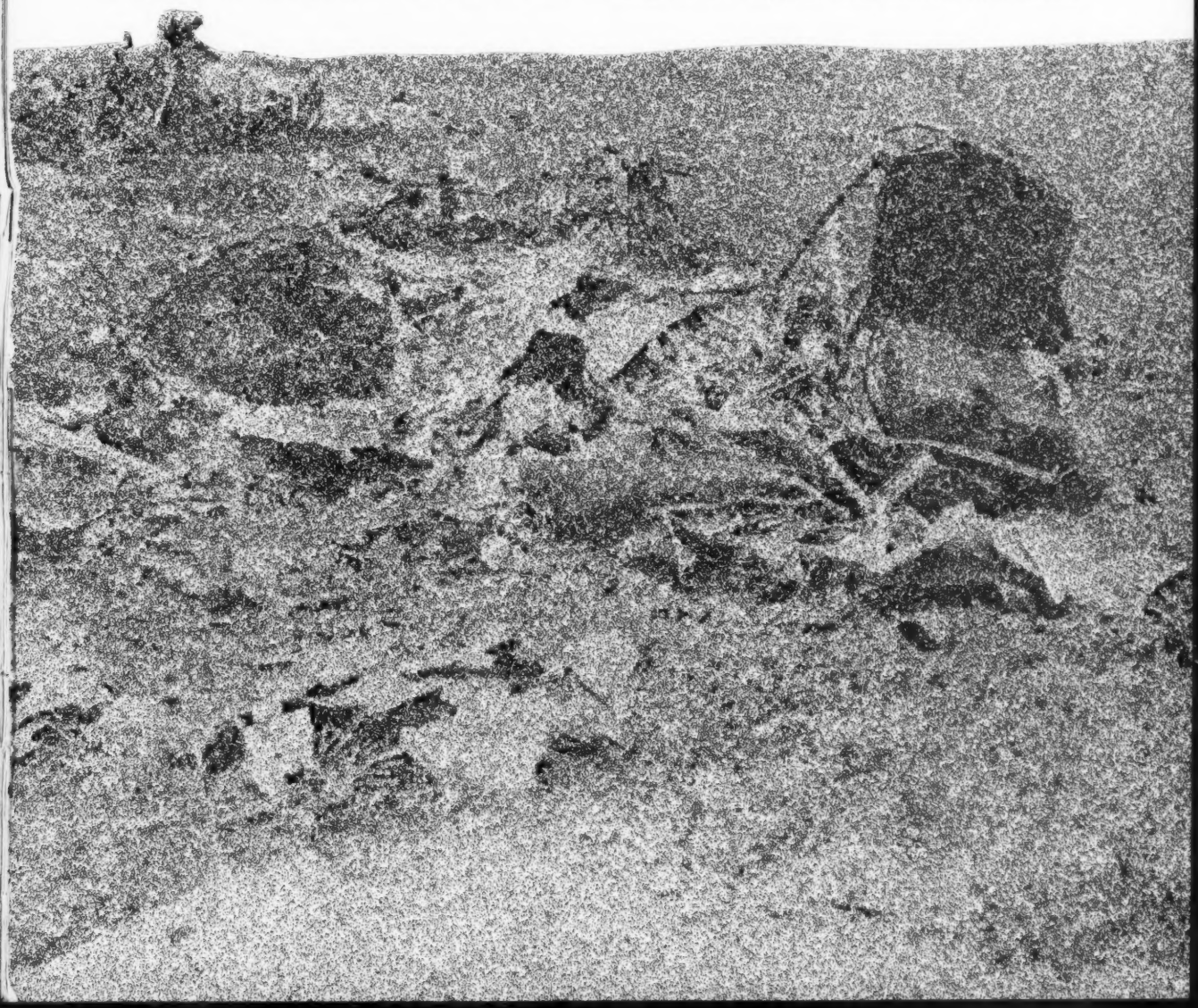
USABAAR

INTRODUCTION

WHILE ENGAGED in training, a light observation helicopter was on the downwind leg of a heliport traffic pattern in late afternoon, flying south. The pilot entered a left turn to the eastbound base leg and his helicopter collided with an OH-13 which entered traffic by a straight-in approach to the base leg. Both helicopters crashed, killing the pilots. Visibility was 15 miles and the sun, behind the pilot of the OH-13 and to the right of the other pilot, did not obstruct the visibility of either pilot. This training environment accident occurred because neither pilot saw the other helicopter in time to initiate evasive actions to avoid collision.

During a right echelon formation of four UH-1Hs in a combat area, the pilot of the No. 3 helicopter flew too close to the No. 2 helicopter and the main rotor blades collided. The No. 2 helicopter was crash landed, with extensive damage. The No. 3 helicopter fell to the ground and exploded, killing the crew of four. This tactical environment



accident occurred because the No. 3 pilot attempted to fly excessively close formation in violation of established rules.

The above excerpts, taken from Army aircraft accident investigation reports, vividly portray the results of midair collisions. There are a few midair collisions recorded wherein only minor damage to one or both aircraft occurred. These are exceptional since most midair collisions are catastrophic, resulting in destruction of the aircraft involved and the death of the occupants. Midair collisions have long been one of the gravest hazards to safe flight. As aircraft density increases in both the combat and noncombat environment, the potential for the occurrence of midair collisions increases correspondingly, requiring of the crew and controller a greater degree of alertness and care in aircraft operations. Because of density, aircraft speed and persistent hazy conditions, it may well be that aviation in general has passed the point where timely visual detection of other aircraft by the air crew (see and be seen) is sufficient to ensure against the midair collision.

One of the first teaching points voiced by instructor pilots to their students is: "Keep your head on a swivel to prevent collision with aircraft and other hazards to flight." The basic tool used by aviation safety officers to prevent midair collisions is the see-and-be-seen philosophy. This fundamental rule is essential to safe operation of Army aircraft. Yet, it is a fact that aviators inadvertently violate instructor pilots' orders or ignore the see-and-be-seen philosophy and do not see aircraft operating in their vicinity. How many times have you been advised by radar operators that a target is at your — o'clock position and, even after the warnings, been unable to find the other aircraft? I believe the answer is, unfortunately, frequently! It is evident that the see-and-be-seen philosophy is inadequate to prevent midair collisions in training and operational areas which are saturated with military and civilian aircraft.

Technological advancements have proven beneficial in improving the crashworthiness of aircraft and in numerous other areas of the aircraft accident prevention field. Proximity warning devices are presently available which alert aviators of other aircraft in their vicinity. The proximity warning device has been installed in a limited number of Army aircraft. Aviators flying TH-13T helicopters with the proximity warning device installed will respond to any warning received and initiate evasive action necessary to prevent a midair collision. However, they can have confidence in the system only if they know that all other aircraft which may be in the immediate area are similarly equipped. It is apparent that a strong case exists for the installation of proximity warning devices in all Army aircraft. The monetary savings brought about by the prevention of one midair collision involving two UH-1 helicopters would go a long way toward equipping the Army aircraft fleet with proximity warning devices.

Certain constraints make it difficult to modify the Army's aircraft fleet with the proximity warning device in the foreseeable future. It is, therefore, mandatory that all aviators and crew members increase their alertness and initiate actions to prevent midair collisions. Aviation unit commanders must also initiate action to ensure that conspicuity marking of their aircraft is properly maintained. The commander must be alert and recognize indicators that reflect aviators' inattentiveness to regulations and unit standing operating procedures directed toward accident prevention. Aviation staff officers must consider the probability of midair collisions while planning airmobile operations. Sightseeing in the area of airmobile operations landing zones must be eliminated.

As aircraft and cockpit sophistication increase, requiring more head-in-the-cockpit time, the requirement for rapid and effective scanning of areas outside the aircraft increases. Installation of proximity warning devices holds the only promise for assisting air crews to avoid collisions, but these devices can only assist. There will always be a requirement for each member of the Army aviation team to be alert, keep his head on a swivel while airborne to see other aircraft in his vicinity and take necessary actions in his sphere of responsibility to prevent catastrophic midair collision accidents.

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ANALYSIS of 56 midair collisions experienced by the Army revealed that multiple cause factors were present in each accident. It was found the pilots must shoulder the majority of the responsibility for midair collisions. However, it was also found that other factors contributed to the crew errors which resulted in collisions. The full extent that other factors contributed could not be accurately determined be-

cause of the tendency of aircraft accident investigation boards and reviewing officials to accept pilot error as the cause of accidents, without seeking other contributing factors.

General problems encountered in training areas stem from the aircraft saturation within high density areas. Corrective actions to eliminate the problems must be oriented toward reducing aircraft densities in specific training areas. This can be accomplished either by a reduction in the number of aircraft operating in a specific area or through the expansion or relocation of existing facilities.

The most common trend revealed by analyses of accidents in tactical areas was the failure of aviation units to enforce adherence to published regulations. In most cases, adequate operational procedures were established in unit SOPs, field manuals and technical manuals. Adherence to approved procedures would have prevented most of the midair collision accidents.

Inadequate command, control and supervision were present in 50 percent of the midair collisions studied. It was determined that increased command attention must be directed toward the fundamentals of good airmanship, i.e., see-and-be-seen. In addition, new approaches must be taken to improve aircraft visibility and detection. Prominent among these are installation of proximity warning devices, installation of aircraft high intensity lights, and the installation of improved communication systems in air traffic control towers.

Initially, this study was originated to establish a profile of Army midair collisions. This profile was based on data contained in 56 midair collision accident reports, involving 113 aircraft. Information from the reports was analyzed to determine common factors found in midair collisions. Analysis of the initial study generated the following unanswered questions:

1. Why are numerous midair collisions occurring in the training and troop lift/tactical environments?
2. Why are numerous midair collisions occurring during daylight hours in periods of excellent visibility?
3. What is the impact of inadequate command and control and lack of supervision?
4. What is the degree of violation of instructions or procedures and the principles of good airmanship?
5. What action can be taken to eliminate aircraft density around focal points which seem to attract aircraft at random times? (Focal points could be navigation aids, on-going operations, airfields, etc.)

To answer these questions, further analyses of the 56 reports were accomplished. These analyses revealed that conclusions and recommendations resulting from the study of midair collisions during training missions are not applicable in all respects to midair collisions occurring in a troop lift/tactical environment.

Training environment conclusions are:

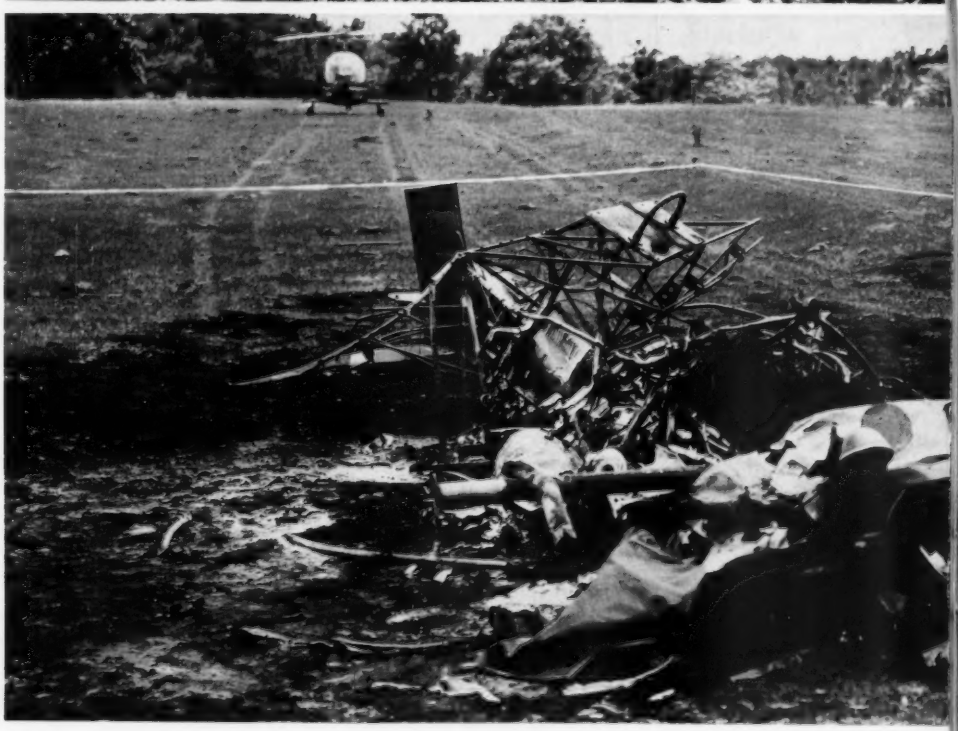
• There is an ever-present possibility of crews being inattentive in a training environment. Stu-

MIDAIR COLLISION PROFILE

The aircraft involved will be of the UH-1 type and the collision will occur between two aircraft during daylight hours with the visibility at 10 to 20 miles. There will be 2.4 crew members per collision aircraft or 4.8 crew members per mishap. There will be 5.03 fatalities (both crew and passengers) in each mishap. The aircraft will be involved in some form of training operations. The crews will have performed 2.7 hours of flight prior to the collision and will have been on duty 5.1 hours of the duty day. The aircraft involved will not be in formation. Neither will they be climbing, nor turning, but will simply converge. They will be in radio communication with each other. The collision will occur between the altitudes of 1,001 feet and 2,000 feet absolute. The two aircraft will not necessarily be using the same navigation facility, and the experience level (flight time) of the aviators in command will not be a factor. The collision will take place in an area of known high density traffic. Inadequate command and control or a lack of supervision will be present in 50 percent of the mishaps. And some degree of violation of instructions or procedures, or the violation of the principles of good airmanship will exist.

ARMY MIDAIR COLLISIONS

Charred remains of CH-47C which collided with fixed wing aircraft at 3,000 feet during tactical mission and tumbled end over end to ground, killing all five occupants



Midair collisions most often result in catastrophic accidents, such as this OH-13 which collided with another OH-13 during training

dent aviators in the early stages of flight training concentrate more on flying the aircraft and devote less attention to the see-and-be-seen concept. The aviator's failure to keep his head on a swivel increases the probability of midair collisions.

• Student pilots flying in traffic patterns under the jurisdiction of air traffic control towers often develop a false sense of security. They frequently fail to clear themselves before executing maneuvers in high density areas.

• Deficiencies in equipment and insufficient number of personnel were contributing factors to nine of the 12 midair collisions which occurred while aircraft were operating in stagefield/airfield traffic patterns.

• The full impact of supervision and command control shortcomings as cause factors was not fully explored by aircraft accident investigation boards due to the tendency to accept pilot error as the only cause for accidents.

• Investigation boards and reviewing authorities made a relatively small number (27) of recommendations for the 25 training accidents. An apparent trend prevailed for boards to find that only the crew or crew member was at fault when other factors were present that indicated other deficiencies.

• Some student pilots failed to take advantage of time provided for crew rest, resulting in fatigue factors.

• A small percentage of student pilots have a history of unsafe flying practices which may well develop into major contributing factors for midair collisions.

• Aircraft visibility restrictions contribute to the pilot's failure to see other aircraft in time to avoid collisions.

• Ten of 13 collisions could have been prevented if a functioning proximity warning device had been installed aboard each aircraft involved.

• Insufficient use of the Operational Hazard Report (OHR) system may be attributed to a lack of knowledge about its intent and the aviator's fear that the information contained in the report might impinge on his personal reputation or professionalism.

• Aircraft without distinctive conspicuity markings are more apt to be involved in midair collisions.

• The intensity of the Grimes anticollision light is not sufficient to ensure that student pilots see other aircraft in time to avoid collisions, especially during full daylight hours.

• The see-and-be-seen concept is still the primary method available for preventing midair collisions.

• Command emphasis in the form of constant evaluation of air traffic density, revision of air traffic control regulations and strict control of aircraft operations is mandatory if a reduction in the number of midair collisions occurring in training environments is to be achieved.

• A rapid turnover of key personnel contributes to a higher number of midair collisions.

• Formation flight midair collisions do not occur when tightfisted command and control procedures culminate in detailed briefings, maintenance of prescribed separation between the aircraft and adherence to safe flying practices.

• Violations of regulations and published SOPs contribute greatly to midair collisions.

• The fluctuating concentration of aircraft, varying between moderately saturated to highly saturated over such areas as stagefields, airfields and navigational facilities, increases the probability of midair collision mishaps.

Troop lift/tactical environment conclusions are:

ARMY MIDAIR COLLISIONS

• Loss of visual contact between aircraft during night operations contributes to midair collisions.

• Air crews are more susceptible to midair collisions during prime recovery periods following missions.

AH-1G crashed inverted in marsh and water after collision with OH-13 in photo above. Two occupants were killed and one survived with major injuries

• Cumulative fatigue resulting from excessive flying hours contributes to midair collisions.

• Inadequate command, control and supervision constitute a serious problem area. It is not uncommon to have two or more of these elements involved in one midair collision.

• Supervisory deficiencies receive little or no attention by aircraft accident investigation boards and reviewing officials. The primary emphasis is concentrated on real or assumed faults of the air crew.

• The present system for disseminating changes to SOPs, NOTAMs and other information to individual aviators is inadequate. Aviators often learn about changes in operational procedures and policies through mistakes and experience.

• Violation of instructions, procedures and principles of good airmanship are involved in most midair collisions.

• Midair collisions increase as aircraft inventory increases in a combat zone.

• Diversion of attention and preoccupation of crews due to concentration on ground actions in combat areas contribute to collisions.

• There will be no appreciable change in aircraft density in the vicinity of focal points, i.e., landing and pickup zones, tactical areas of operation, base camp heliports, etc., in low intensity warfare operational areas. The concept of providing airmobility to enhance ground operations results in large numbers of Army helicopters and fixed wing airplanes, as well as numerous aircraft of other services and nations, using the airspace above the ground forces.

• Broad use of the Operational Hazard Report system can become a very effective tool in the prevention of midair collisions by identifying potential focal points.

Recommendations for the training environment are:

• Use of buddy riders to increase the number of eyes available for outside surveillance.

• Increased emphasis on the necessity for student pilots to always clear themselves before executing maneuvers.

• Command emphasis in the form of constant evaluation of air traffic density, revision of air traffic control regulations and strict control of aircraft operations.

• Greater efforts by aircraft accident investigation boards to identify and substantiate all contributing cause factors for each accident.

• Aircraft accident investigation boards and reviewing officials must develop positive and viable

recommendations to prevent recurrence of all cause factors associated with every accident.

- Command insistence that student pilots take full advantage of time provided for crew rest.
- Greater command emphasis on the detection and elimination of marginally safe students at an early stage of flight training.
- Elimination of design restrictions to visibility for future aircraft procured for training and modification to eliminate restrictions to visibility for training aircraft in the current inventory.
- Installation of proximity warning devices in all aircraft.
- Continuing command emphasis on an education program to promote use of the operational hazard reporting system.
- Conspicuous markings for all training aircraft in noncombat areas.
- Use of high intensity strobe lights to increase aircraft conspicuity during daylight operations.
- Continuous command action to ensure the use of the see-and-be-seen concept.
- Continued command actions to offset the effects of a rapid turnover of key training personnel.
- Continuous and tight supervision over all formation flights to ensure maintenance of at least two rotor discs separation between aircraft.
- Command emphasis to ensure that aviators at all levels know and understand published directives and unit SOPs concerning formation flying.
- Radar vectoring of traffic in high density areas.
- Assignment of and adherence to prescribed routes and altitudes in training areas.

Recommendations for the troop lift/tactical environment are:

- Development and use of techniques to avoid loss of visual contact resulting from flare illuminations at night.
- Improved planning and closer coordination between aircraft crews in fire support teams.
- Continuing emphasis on increased alertness and aircraft separation during prime recovery periods after missions are flown.
- Increased command emphasis on adhering to recommended limitations for daily and monthly crew member flight hours to prevent cumulative fatigue.
- Command emphasis in the form of constant surveillance of air traffic density, revision of air traffic control regulations and strict control of aircraft operations. Particular attention must be given to aircraft density during unit buildups in low intensity warfare areas of operation.
- Deliberate efforts by aircraft accident investigation boards to identify and substantiate all possible cause factors contributing to each accident.
- Improvements in the publication and dissemination of flight directives, flight information and SOPs.
- Continuous command emphasis on adherence to published regulations and SOPs.
- Command emphasis on continuous alertness of all air crew members to detect other aircraft in the vicinity of their aircraft.
- Command emphasis on improved selection of landing zones, pickup zones and staging areas.
- Command emphasis on an education program to promote full use of the operational hazard reporting system.
- Increased supervision to prevent close formation flying in violation of published regulations.
- Prohibition of unplanned formation flights.
- Elimination of formation flying that is unnecessary to accomplish missions.
- Improved planning and better supervision while conducting and executing airmobile operations.

TRAINING ENVIRONMENT COLLISIONS

Question: Why are numerous midair collisions occurring during daylight hours in periods of clear visibility?

Findings:

Twenty-five midair collisions occurred in the training environment. Analysis revealed that 23 midair collisions occurred during periods of excellent visibility.

Aircraft density and the false sense of security of aviators while flying in traffic patterns under the jurisdiction of a control tower were the two major factors in these mishaps, as shown below:

Situation	No. of Mishaps	% of Sampling
Flying in a high density area	24	96%
Flying under jurisdiction of a control tower	12	48%

In a training environment, there is the ever-present possibility of crews being inattentive. Student aviators, in the early stages of flight training, concentrate more on flying the aircraft and devote less attention to the see-and-be-seen concept. This increases the probability of midair collisions due to the reduced chances of the aviators detecting other aircraft in time to avoid collisions.

In 13 of the 25 training midair collisions, one or both aircraft were flown solo. Only one pair of

eyes was available for outside surveillance in 32 of the 50 aircraft involved. The average flight experience of solo students involved in midair collisions was 52.1 hours.

Conclusion: Careful consideration should be given to the use of buddy riders and their value in preventing midair collisions. This would increase the number of eyes available for surveillance outside the aircraft.

Question: What is the impact of inadequate command and control and lack of supervision?

Findings:

Prior to 1966, the number of midair collisions did not appear significant due to the scattered and isolated pattern of occurrences. Following are the numbers of collisions by calendar year:

Year	Number of Mishaps
1963	1
1964	3
1965	2
1966	8 (high)
1967	3 (low)
1968	7 (high)
1969	1 (low)

The increased frequency of midair collisions subsequent to 1965 clearly indicates that command emphasis in the form of constant surveillance of air traffic density, revision of air traffic control regulations and strict control of aircraft operation is a mandatory requirement. The large number of collisions during calendar year 1968 is attributed to the rapid turnover of key personnel at the aviation training bases. Command actions were initiated in 1967 and again in 1969 which appreciably reduced the number of midair collisions for those 2 years. Some of the positive actions taken were:

Radar vectoring of traffic in areas of high density.

Assignment of prescribed routes and altitudes.

Overall command emphasis in the elimination of midair collision mishaps.

Following are the locations of the 25 midair collision mishaps occurring in a training environment:

Location	Number of Mishaps
Fort Wolters, Texas	10*
Fort Rucker, Alabama	8*
Fort Stewart, Georgia	2*
Fort Benning, Georgia	2
Other CONUS Locations	1
Republic of Vietnam	2**

*Twenty of the 25 midair collisions occurred in ultrasaturated training areas.

**The two collisions in the Republic of Vietnam occurred in a training environment.

Supervision appeared as a significant cause factor in the 31 midair collisions occurring in a troop lift/tactical environment

The 12 training midair collisions which occurred while aircraft were operating in stagefield/airfield traffic patterns revealed that tower operations and deficiencies in equipment and personnel actions listed below were present and contributing factors in nine accidents:

Tower operators did not exercise positive control of air traffic in their area of responsibility.

The communications equipment installed in some towers does not provide transmitting and receiving capability with all aircraft operating in the vicinity of the airfield.

The design and location of towers used to control air traffic, particularly at training stagefields, restricts the visibility of air traffic controllers.

There were cases where inadequate manning of the control tower with fully qualified air traffic controllers resulted in these personnel being unable to control all the aircraft operating in the vicinity of the airfield.

Additional supervisory errors present pertaining to airfield/stagefield areas were:

Effective control measures, such as establishment of traffic patterns and distribution of traffic pattern diagrams, had not been initiated.

Standing operating procedures were not published in many instances. SOPs were inadequate to ensure separation of aircraft operating in the local area in many accident reports reviewed.

Analysis of the 25 training collisions revealed the following additional information:

Thirteen collisions occurred in authorized training areas.

Six midair collisions occurrred over navigational facilities.

Only three of the 25 accident investigation reports stated that adequate regulations were published.

Nine accident reports stated that a detailed survey of the local training areas should be conducted to prevent recurrences.

Formation flying, primary phase of training: A significant finding was that no mishaps occurred during formation flying in this phase of flight training. This can be attributed to tightfisted command and control, adequate briefings and adherence to safe flying practices.

Formation flying, advanced phase of aviation unit training: Two midair collisions occurred, resulting in the loss of four aircraft and 24 fatalities. Both occurred in an advanced stage of training just prior to unit deployment and involved the No. 2 and No. 3 aircraft in flights of four aircraft. Although responsibility for maintaining proper separation between aircraft under VFR conditions rests with crew members, command supervision was determined to be an established factor in both collisions because:

Radio silence was imposed for training reasons and hand signals were being used.

A UHF (primary) radio had been removed from one of the aircraft prior to flight.

SOPs were not adequate to govern formation flights.

An aircraft commander executed flight maneuvers without first notifying the crews of every aircraft in the flight of his intentions. (A pilot error cause factor would be valid in these mishaps if the aircraft were not part of a formation of aircraft under the command and control of a flight leader. Strict discipline and immediate response to the commands of the leader are mandatory during formation flight. Therefore, responsibility for the safety of all aircraft in the flight rests with the flight leader.)

Training missions were conducted in marginal weather, with reduced visibility.

Established safeguards for avoiding pilot fatigue were not adhered to. The crew members of two aircraft had exceeded the maximum recommended flight time for a 30-day period.

Conclusion: All aspects of command, control and supervision as accident cause factors were not fully explored by accident investigation boards. The tendency was to accept pilot error as the only cause of the accidents. Investigation boards made only 27 positive recommendations in the reports of investigation of the 25 midair collisions occurring in the training environment. The recommendations included improvement of training areas, regulations and local SOPs. This is a small number of recommendations, considering environmental conditions in which the accidents occurred. Five of the recommendations made were disapproved by approving authorities. It was noted that a trend prevailed for accident investigation boards to find the crew at fault when other causative factors were present. This is substantiated by the fact that accident investigation boards submitted less than one recommendation per accident that would reduce hazardous environmental conditions.

Question: What is the degree of violation of instructions or procedures and the principles of good airmanship?

Findings:

Violation of published regulations and SOPs occurred in nine of the 25 training midair collisions. The following violations occurred:

Prescribed traffic patterns were not followed.

Proper separation was not maintained.

Deviations from designated flight routes.

Communication radios not tuned at designated times.

Noncompliance with control tower instructions.

Crew members did not ensure there were no other aircraft operating in the area prior to executing maneuvers in a high density area in 13 of the 25 midair collisions occurring in the training environment.

Nine midair collisions occurred when one aircraft descended on top of another and four occurred when one aircraft climbed into another. Five of these collisions involved aircraft on approach to the same runway/lane.

Crew member fatigue was an established causative agent in two accidents and present in two others. Ample time was provided for crew rest. The student pilots did not take advantage of this time. Fatigue of any crew member impinges on the basic principles of good airmanship.

One or both student aviators involved in three midair collisions had histories of unsafe flying practices prior to the accidents. This fact was revealed through a review of instructor pilot statements and individual flight records of the students. The unsafe flying practices of these three students were prime contributing factors to the midair collision accidents.

Conclusions:

Student aviators must devote more attention outside the aircraft, rather than concentrating entirely on flying the aircraft and monitoring gauges.

Detection and elimination of marginally safe student aviators at an early stage of flight training should receive greater command emphasis.

Question: What action can be taken to eliminate aircraft density around focal points which seem to

attract aircraft at random times? (Focal points could be navigation aids, on-going operations, airfields, etc.)

Findings:

During the day, aircraft density continuously shifts throughout training areas. Although entire training areas remain areas of high aircraft density, concentrations of aircraft in certain sectors fluctuate from moderately saturated to highly saturated areas. Stagefields, established airfields and navigational facilities are generally in the highly saturated areas.

Time of day appeared to have no significance. A greater number of midair collisions occurred, however, during launching and recovery periods, as shown below:

Period of Day	Number of Mishaps
0700-0900 hours	4
0900-1100 hours	5
1100-1300 hours	4
1300-1500 hours	3
1500-1700 hours	8
After 1700 hours	1 (night)

An aircraft design deficiency was a contributing factor in three midair collisions involving TH-55s. These mishaps resulted in five fatalities and the loss of four aircraft. The 4-inch metal doorframe of the TH-55 restricts visibility on both sides of the aircraft. This problem, first noted during December 1966, was brought to the attention of appropriate authorities by the training command using the aircraft. The design deficiency remains uncorrected.

Conspicuity was reported as a possible contributing factor for 12 of the 25 collisions due to:

Inadequate anticollision lights	7*
Aircraft without distinctive markings	3
Sun	2

*Investigations revealed no evidence that anticollision lights were not in use by either aircraft involved.

Installation of proximity warning devices was recommended by boards investigating four of the 13 collisions which occurred in training areas while aircraft were in the vicinity of navigational aids/facilities. Consideration was given to air speeds, altitudes, locations and phases of flight to determine how many of the 13 collisions could have been prevented by the warning provided by a proximity warning device. This analysis disclosed that 10 of the 13 could have been prevented if a functioning proximity warning device had been installed aboard each aircraft. The air crew members involved in these 13 collisions were unaware of the presence of another aircraft.

During 1967 the Federal Aviation Administration (FAA) adopted a reporting program for near midair collisions (NMAC) which granted immunity to those involved. An analysis of 2,230 NMAC reports received by the FAA resulted in the compilation of 700 recommendations which would improve operating conditions and assist in preventing midair collisions. The Operational Hazard Report (OHR), DD Form 2696, used by the military services, offers no such immunity. AR 95-1 states that the originator's signature on the OHR is desirable, but not mandatory. Analysis of midair collisions revealed that the OHR is seldom used to report potential midair collision causative agents. An aviator's reluctance to use the OHR may be attributed to his lack of knowledge of its intent and purpose, or his fear that information contained in the report might impinge on his personal reputation or professionalism.

Conclusions:

Serious consideration must be given to eliminating design restrictions to visibility for all future Army aircraft procured for training. Current Army training aircraft should be modified to eliminate design visibility restrictions.

Proximity warning devices should be a requirement for all aircraft.

Operational Hazard Reports, DD Form 2696, are not being effectively used to identify existing and potential hazardous focal points. The OHR is a very effective tool for preventing midair collisions. Corrective measures must be instituted to eliminate hazards to safe flight that are identified in Operational Hazard Reports.

Currently authorized anticollision light systems are inadequate for a training environment. Serious consideration should be given to the use of high intensity strobe lights to increase aircraft conspicuity during daylight training operations.

The see-and-be-seen concept is the primary method available for preventing midair collisions.

TROOP LIFT/TACTICAL ENVIRONMENT COLLISIONS

Question: Why are numerous midair collisions occurring during daylight hours in periods of clear visibility?

Findings:

Thirty-one midair collisions occurred in a troop lift/tactical environment. Twenty-three occurred during periods of excellent visibility. This is not unusual because the majority of combat missions flown in the Republic of Vietnam are conducted under these conditions. Following are the condi-

This UH-1B was one of two which collided and crashed during training, killing all four occupants and destroying both aircraft

tions and numbers of collisions for each:

Condition	Number of Collisions
Excellent visibility	23
Night/reduced visibility	5
Day, weather/dust	3

Four of the five night collisions involved UH-1B/C armed helicopters. Two factors evident in these mishaps were:

Loss of visual contact with other aircraft after flare illuminations.

Loss of visual contact between aircraft of the light fire team while conducting fire support missions.

The 31 collisions involved a total of 63 aircraft. Seven aircraft were assigned to other services. There was no established trend as to locations where a midair collision between an Army aircraft and an aircraft from the other services occurs. As many took place in the vicinity of focal points as there were in operational areas.

Time of day appeared to have no great influence on midair collisions. A greater number occurred between 1500 hours and 1900 hours. This is a prime recovery period to base camp heliports after missions are flown.

Time of Day	Number of Collisions
0500-0700 hours	3
0700-0900 hours	5
0900-1100 hours	2
1100-1300 hours	3
1300-1500 hours	2
1500-1700 hours	6
1700-1900 hours	5
After 1900 hours (night)	5

Fatigue was an established factor in five of the 31 collisions, according to the aircraft accident investigation reports. Further analysis revealed that the pilot in command of 37 of the 56 Army aircraft involved had flown in excess of 90 hours during the 30-day period prior to the accident. Of these 37, 29 aviators had exceeded 100 flight hours. Their total flight time for the 30-day period prior to the accident ranged from 101 to 167 hours. There was little or no mention of chronic flight fatigue, living conditions, mission requirements, or the stress of operating in a hazardous combat environment in the reports.

The constant requirement for formation flying is evidenced by the fact that 16 of the 31 collisions occurred while formation flying was in progress

by one or both aircraft involved.

Conclusions:

There will be no appreciable change in aircraft density in the vicinity of focal points, i.e., landing and pickup zones, tactical areas of operation, base camp heliports, etc., in low intensity warfare operational areas. The concept of providing airmobility to enhance ground operations results in large numbers of Army helicopters and fixed wing airplanes, as well as numerous aircraft of other services and nations, using the airspace above the ground forces. The majority of midair collisions that occur in Vietnam will occur during daylight hours and there will be no severe restriction to visibility.

Flight time accumulated in excess of 100 hours per 30-day period is accepted by commanders and aircraft accident investigation boards. This problem can best be summed up by one flight surgeon's statement: "Chronic flight fatigue is cumulative and occurs due to incomplete physical and mental recuperation between repeated missions."

A requirement exists for adherence to flying hour limitations recommended by Army regulations. Personnel who exceed these maximum limits must be monitored by flight surgeons and aviation unit commanders to ensure detection of complacency which could cause aviators to become prone to accidents.

Question: What is the impact of inadequate command and control and lack of supervision?

Findings:

Inadequate command, control and supervision were present in 27 of the 31 collisions. This is a serious problem area. It was not uncommon to have two or more of these factors present in each midair collision. Following are the most common factors:

Laxity in flight control during formation flying.

Inadequate planning and improper execution of airmobile exercises.

Selection of inadequate landing zones, pickup zones and staging areas.

Absence of adequate published and approved SOPs and directives, and inadequate dissemination and enforcement of existing rules and procedures.

Absence of or insufficient coordination between different services.

Inadequate, or absence of, air traffic control facilities and ATC regulations.

Midair collisions between aircraft involved in formation flying accounted for 52 percent of the 31 mishaps. It is, therefore, necessary to elaborate on this category separately. Twelve of the 16 midair collision mishaps occurred between aircraft within a formation. The remaining four mishaps involved an aircraft not in formation flight with another aircraft which was in a formation. All collisions involved the No. 1, 2 and 3 aircraft, regardless of the size of the formation. Following are the factors revealed by this analysis:

Positive control was not maintained. This is evidenced by the flight leader permitting unnecessarily tight formation flying in violation of published regulations.

Conducting missions in marginal weather.

Conducting formation flights unnecessary to accomplish missions.

Conclusions:

Supervision appeared as a significant causative factor in the 31 midair collisions analyzed. However, these deficiencies received little or no attention by accident investigation boards and reviewing officials. Primary emphasis appeared to be concentrated on aviator factors.

The present system for disseminating changes to SOPs, NOTAMs and other information to individual aviators is inadequate. Aviators often learn about changes in operational procedures and policies through mistakes and experience.

Contrary to common beliefs, statistics derived from this study showed the danger area for a midair collision in formation flying centers around the No. 1, 2 and 3 aircraft.

Question: What is the degree of violation of instructions or procedures and principles of good airmanship?

Findings:

Crew error was listed as an established cause factor in the reports of 24 of the 31 collisions. Analysis of the 31 reports disclosed that violations of instructions/procedures and principles of good airmanship were present in all cases. Following are the four most prominent violations:

Aviators did not clear themselves and/or maintain a careful watch for other aircraft.

Adequate separation was not maintained between aircraft in formation flight.

Published regulations and SOPs were not followed.

Aviators did not maintain visual contact with other aircraft.

Five of the formation flight collisions occurred as the result of spur of the moment decisions to fly formation without prior planning. These five mishaps resulted in 18 fatalities, 11 serious inju-

ries and eight destroyed aircraft. Flights of this nature are in complete disregard for normal margins of safety and good airmanship.

Conclusions:

There is a need for aviators at all levels to know and comply with directives and SOPs pertaining to formation flying.

Formation flying that is not necessary for mission accomplishment must be eliminated.

Unplanned formation flying must be eliminated.

Question: What action can be taken to eliminate aircraft density around focal points which seem to attract aircraft at random times? (Focal points could be navigation aids, on-going operations, airfields, etc.)

Findings:

Midair collisions increased as the aircraft inventory increased in the combat zone. Following are the numbers of collisions by calendar year:

Calendar Year	Number of Collisions
1963	0
1964	1
1965	3
1966	4
1967	7
1968	8
1969	8*

*Includes only the number of collisions through 29 October.

Focal points:

Navigation facilities. Two midair collisions occurred over navigation facilities; one when the facility was being used as a check point and the other when an aircraft collided with an Air Force aircraft over a navigation facility while the Air Force aircraft was making an instrument approach.

Ten midair collisions occurred in the vicinity of airfields, heliports, pickup zones and staging areas. Cause factors included:

Violations of published procedures.

Regulations governing traffic patterns and air traffic flow around congested areas were not published.

Inadequate communications.

On-going operations. Nineteen collisions occurred in operational areas. Aircraft density in these areas is generated by existing combat situations. Paramount cause factors in areas of on-going operations were lack of command and control, observation aircraft flying without a trained observer and significant ground action present.

Eight occurred during combat assaults with significant ground action present. In five of these reports, it was stated that ground action was distracting and diverted the attention of the crew.

Five occurred between Army aircraft and aircraft of another service with no significant ground action present.

Six occurred after missions had been completed and the aircraft were en route to home bases.

It was significant that armed helicopters were involved in 10 of the 31 collisions. This degree of involvement is high with respect to the number of armed aircraft in the tactical zone. Some of the factors revealed by analysis of collisions involving armed helicopters were:

Preoccupation of aircraft crews due to significant ground action.

Failure to maintain visual contact between aircraft on the same fire support mission.

Lack of command and control procedures between armed helicopters and other elements of troop lift flights.

Operation of armed helicopters during the hours of darkness without external lighting.

Conducting unnecessarily close formation flights which were not required for successful completion of missions.

Conclusions:

There will be no appreciable change in aircraft density in the vicinity of focal points, i.e., landing and pickup zones, tactical areas of operation, base camp heliports, etc., in low intensity warfare operational areas. The concept of providing airmobility to enhance ground operations results in large numbers of Army helicopters and fixed wing airplanes, as well as numerous aircraft of other services and nations, using the airspace above the ground forces. The majority of midair collisions that occur in Vietnam will occur during daylight hours and there will be no severe restriction to visibility.

Immediate command attention must be given to strengthening command and control procedures in areas of on-going operations. Measures must be initiated which will ensure control of the number of aircraft within an operational area, coordination between all combat elements within the area (including the other services) and individual command and control of organic elements.

There is a vital need for controlling agencies of focal points, such as airfields, heliports and navigational facilities, to ensure the establishment of and compliance with the best possible traffic regulations and procedures.

All phases of armed helicopter operations must be analyzed to develop corrective measures for reducing the high susceptibility of armed helicopters to midair collisions.

COMPROMISES Without Cause

Gerard M. Bruggink
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Bureau of Aviation Safety
National Transportation Safety Board

From the author's presentation to the Flight Safety Foundation 23rd Annual International Air Safety Seminar, Washington, D. C., 26-29 October 1970

WITH THE HINDSIGHT of thorough accident investigations, most accidents are foreseeable. While our accident data banks are bulging with this after-the-fact wisdom, we keep telling ourselves we have to learn more about accident causes and human behavior before we can achieve greater safety. It is my contention that it is not lack of knowledge, *but reluctance to apply our present knowledge* that limits the effectiveness of our efforts and expenditures.

Before continuing, let me assure you that I am not a crusader for a utopian form of aviation. I am very much aware of the fact that the profit motive and fear of litigation are probably our healthiest allies in the search for a better safety record. Our free enterprise system does not allow us to treat commercial aviation in the same manner as a moonshot. We would have a hard time finding a memorable quote for every passenger who puts his foot on the ground. Certain compromises have to be made, simply because we are in aviation to make a living, not for charitable reasons. However, I hope to prove that too many of our accidents result from compromises that have no economic or rational justification.

With the exception of serious design, manufacturing and maintenance deficiencies that manifest themselves suddenly and catastrophically, most accidents are triggered by an event that becomes critical only because of the context of the circumstances in which it occurs. When the circumstances that govern the criticality of the original event are self-induced, as a result of complacency, misplaced economy, or unprofessional behavior in general, I call them compromises. An example in the form of a military accident may be the most diplomatic way to illustrate this point.

The No. 4 ship in a flight of four helicopters experienced an engine failure shortly after liftoff. As it settled back toward the ground, at considerable forward speed, the pilot found himself in zero-zero conditions due to the dust raised by the preceding aircraft. The helicopter struck an isolated tree, crashed and burned. Examination of some of the factors that turned this engine failure into an accident provides a basic lesson in accident prevention. In the first place, the leader of this formation took off downwind for no other reason than convenience and thoughtlessness. This uncalled for compromise not only reduced the probability of a successful abort, but it may actually have induced the engine failure by forcing No. 4 to exceed the engine limitations of his heavily loaded helicopter. Secondly, the unit involved had not complied with prescribed dust suppression procedures. If the pilot had not lost visual reference, he would have been able to put

the helicopter down with minor damage at most. In the third place, the helicopter involved had a history of intermittent intercom failure. While the pilot was trying to maintain control by reference to the gauges, the copilot happened to notice the impending collision with the tree. However, when he tried to warn the pilot, the intercom was dead and time ran out.

Regardless of the importance we may want to attach to the engine failure, we have to remember that this failure became critical *only*—caused an accident *only*—because of the self-imposed circumstances in which it occurred. The stage for this accident was set by three compromises—the downwind takeoff, the lack of dust suppression and the failure to fix the intercom. Elimination of any of these would have prevented the catastrophic consequences of the engine failure. In a broader sense, these conditioning circumstances were nothing but compromises with regard to established practices and procedures that had been tolerated as long as there were no ill effects. Let me add here that this all too human tendency does not affect the military only.

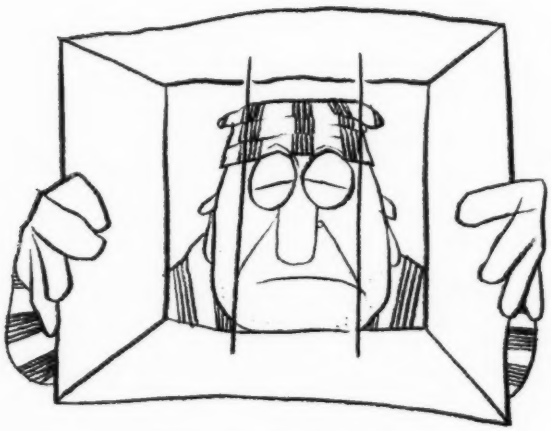
There is another lesson in this accident. If we cannot prevent the failure of a major component or subsystem without pricing ourselves off the market, we should at least make an honest effort to make the total system more immune to the catastrophic potential of such failures. This type of immunity starts with awareness at all levels of the fact that even minor compromises with regard to professional standards of behavior or practices can be the critical link in an otherwise harmless and random set of circumstances. As I will show with examples taken from our own files, the smallest and least costly compromise can become a key factor in a particular set of circumstances over which we have no control.

A four-engine jet transport was inadvertently flown into the water at night, during inclement weather, while making an approach with which the crew was not familiar. This approach definitely required the full attention of everybody in the cockpit. However, this aircraft had a minor discrepancy: One of the nose landing gear indicator light bulbs had been inoperative for some time. The redundancy in the system, in the form of two bulbs, may have made it easier to accept this apparently innocuous compromise. For unknown reasons, a loose electrical connection in the circuitry of the other bulb developed and the crew did not receive the down-and-locked light when the gear was lowered. The captain and flight engineer tried to ascertain the position of the nose gear while the first officer continued the difficult approach. In other words, during the most critical part of the approach, a distraction developed that set the stage for the accident. Although there may have been alternatives available to the crew, the fact remains that the failure to revlace a 50-cent bulb became a basic ingredient in the chain of events.

Here is another example. A four-engine jet crashed and burned on a night takeoff because the crew attempted to get off the ground without flaps. The system that should have warned the crew of the unsafe takeoff configuration was not activated. The reason? A low ambient temperature enabled the crew to obtain takeoff thrust at a power lever setting below the triggering value of the warning system. This peculiarity of the system was known and a simple inexpensive fix had been developed, but lack of imagination resulted in procrastination all along the line. Let our litigation-conscious society worry about the blame distribution in a case like this. We should draw the conclusion that a modicum of alertness and imagination can prevent such occurrences.

Without quoting cases, I want to direct your attention to the MEL—the minimum equipment list—as a potential source of accident-inviting circumstances. The MEL, by its very nature, is a compromise as well as a convenience, in that it allows operation of aircraft in less than optimum condition. This temporary relaxation of standards may lead, and has led, to delays in the repair of affected components inconsistent with sound maintenance and engineering practices. I would also like to point out that the system approach in the compilation of the MEL is the only assurance that all possible implications of a particular compromise are fully understood.

The next example deals with compromises in the operational area. This was also a case of a night takeoff with the wrong flap setting. This time, the warning system operated promptly and properly. The crew tried to locate the problem while continuing the takeoff roll, but their efforts were unsuccessful. The aircraft crashed and burned shortly after leaving the ground. The compromise in this case was the absence in the



You never know when it pays to follow the straight and narrow path and be a good guy. Too often we look at safety as the absence of accidents. This can become a negative attitude, similar to that of a lawbreaker who measures his success by the number of times he got away with it

operations manual of specific instructions as to the crew's reaction when the horn sounds during takeoff. The apparent reluctance to standardize a procedure without loopholes may have resulted from the fact that some crews had been able to troubleshoot the reason for the warning horn while continuing the takeoff. There may also have been an economic consideration based on the delay inherent in an aborted takeoff. In the meantime, it is interesting to compare the similar effects of a properly functioning safety device with one that was defective.

While sums are being expended on exotic research in the human factors field—such as the effects of international travel on ovulation cycles—we fail to tackle obvious regulatory compromises that invite personnel error accidents. Take FAR Part 135, as an example. In a study of Air Taxi accidents, published in May this year, the Safety Board expressed its concern about the effect of pilot experience on the incidence of crew-involved accidents. To quote the Board: "Under the regulations as they now stand, it is at least a possibility that the pilot in command of an Air Taxi flight might have as little as 160 or 200 hours of total flying experience and only 1 or 2 hours of experience in type." Compared with the experience requirements in Part 121, one is inclined to say that Part 135 discriminates against the uninformed air traveler. I realize there has to be a lot of give and take, for economic reasons, but I don't think *all* the giving should be done by the traveling public.

So far, I have discussed compromises at what could be called the corporate and regulatory level. More intangible, but also more productive, is the area of individual compromises with, or without, management sanction. Unfortunately, this is also the area where our computers practically become mute. They can identify the results of human behavior, but not its causes. Two days after an accident, you may learn more about what really happened in informal discussions than the computer will ever know. Since the true answers to many of our accidents are so speculative and personal, they won't be found in our accident reports. Nevertheless, I will attempt to generalize what I consider some of the common denominators that lead to compromises in individual and team performance.

Approach and landing accidents, often in con-

junction with weather, are still a depressing reality. To what extent do operational practices or procedures compromise the performance of crews in these accidents? Do we insist on full use of all the available talent in the cockpit, under all conditions, instead of leaving it to the initiative or the compatability of the crew? Do we need statistical proof that the timely reading of certain instruments by the copilot or a better team approach to transitioning from IFR to marginal VFR can prevent catastrophes? To what extent are we providing practical and firm guidance to pilots who have to stick their necks out on airports without adequate facilities? Do we expect the same performance from a short-haul crew on their sixth IFR approach of the day as we do from an international crew that is exposed only once?

We worry about midair collisions, and properly so. Theoretically, any two aircraft can be flown on collision courses involving vertical closure, without either crew being able to see the other ship. Ironically, though, in many of the collisions that do occur, at least one crew member was in a position to see the other aircraft. I remember two such cases where the crew received traffic advisories 41 seconds and 15 seconds before the collisions. The slow moving targets should have been visible, yet they were not seen. Why not? We'll never know. Preoccupation with the landing checklist could have played a role, although it would indicate a wrong sense of priorities. Fatigue could have been a factor, although there is no reason to assume that it would stand in the way of self-preservation and habitual alertness.

The many irrelevant traffic advisories, prompted by inadequacies of our radar equipment, raise the question: How many times can you cry "Wolf!" unnecessarily, without dulling a crew's sense of urgency? Our failure to standardize some form of external conspicuity requirements may have handicapped the crews.

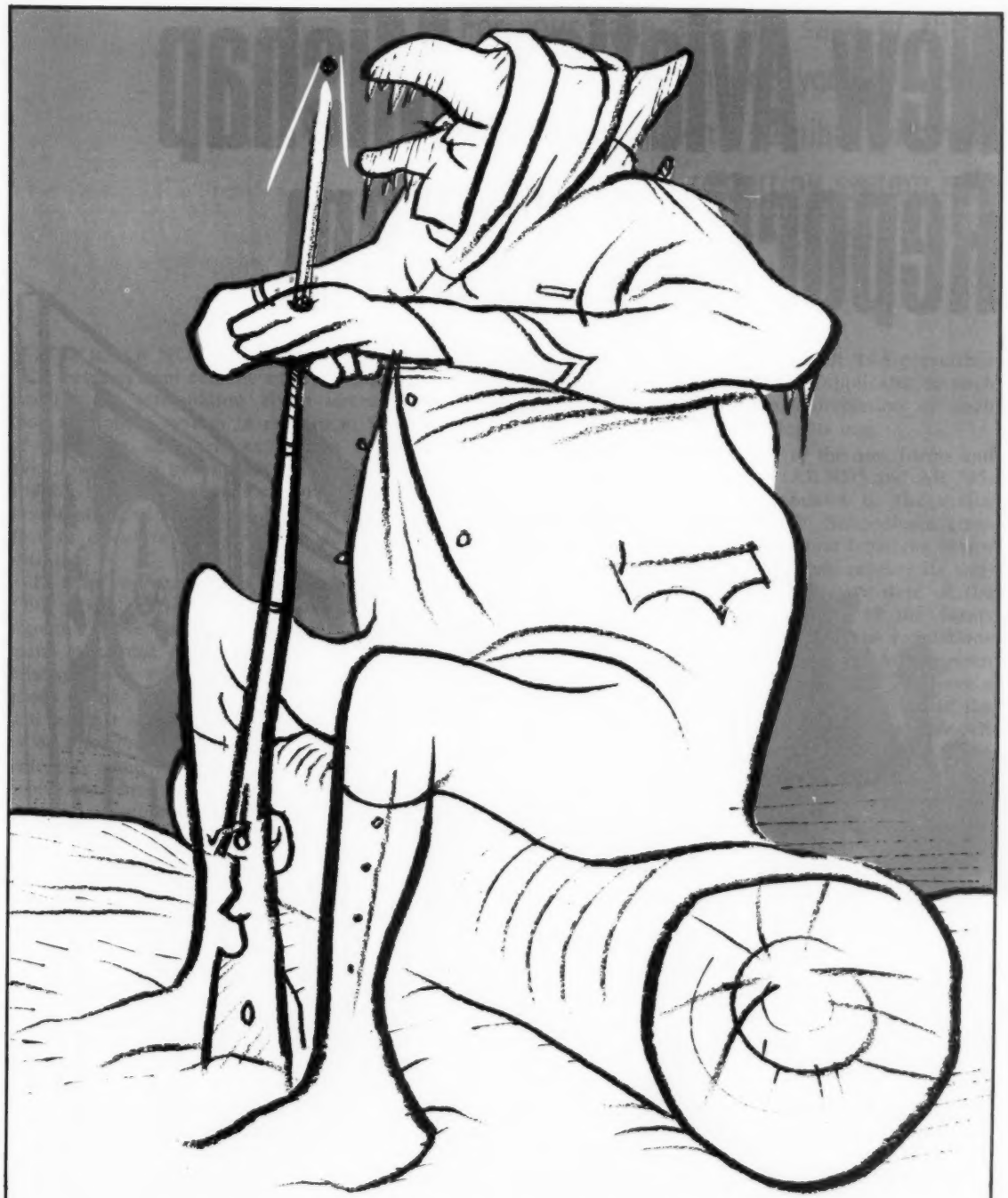
Since I cannot pinpoint the critical compromise in each case, I would like to refer to just one personal observation that I have made, while seeing cockpit crews in action. It appears to me that some of our old-fashioned scanning patterns went by the board when we started flying by-the-book and became introspective with regard to the cockpit. I don't mind admitting that I feel extremely uneasy when I see the man in the left seat make a left turn under VFR conditions without first clearing himself. I don't know what we are teaching these days and who is keeping tab of the standards of basic airmanship. I do believe, however, that a crew with a tendency to compromise can be recognized within 10 minutes after takeoff. I have also learned that humility and self-evaluation contribute more to a sustained level of professionalism than the attitude that rank, age and experience make a man immume to errors.

I hope the few examples I have used and the questions I have raised will convince you that avoidance of certain catastrophes in aviation does not necessarily imply economically catastrophic measures. It starts with the avoidance of compromises without economic and rational justification. In case I failed to convey this message in serious terms, I offer a variation on a story I heard years ago from Colonel John P. Stapp. For the protection of the innocent and not-so-innocent, I'll say it happened in Europe.

A boy drove a motorcycle at night without a headlight. While passing a truck loaded with scrap iron, he decapitated himself on a piece of junk sticking from a hole in the sideboards. The cycle with the headless driver continued and appeared in the truck's headlights. The truckdriver had a heart attack when he saw what had overtaken him. He had a known heart condition but, since he was close to retirement, he was kept in the driver's seat. The truck left the road, hit a house and came to a stop in a suburban bedroom where it interrupted a severe case of adultery. The visiting male was killed.

The analysis of the accidental death in the bedroom, and its prevention, makes sense only when we talk in terms of compromises. There were four of them: (1) The defective headlight of the motorcycle, (2) the poor state of repair of the truck, (3) the heart condition of the truckdriver and (4) the moral standards of the victim.

What it all really amounts to is this: You never know when it pays to follow the straight and narrow path and be a good guy. Too often we look at safety as the absence of accidents. This can easily become a negative attitude, similar to that of a lawbreaker who measures his success by the number of times he got away with it. Safety is the reward for sustained perfection. And perfection in aviation implies that we tackle all manageable compromises, not just those that have been earmarked by an accident.



"George," I said, "when are you gonna stop harping on accidents and give us a battle plan? How can we whip the redcoats with your silly safety rules?"

New Aviation Mishap Reporting System

For your sake and the sake of those who depend on you to supply aviation support, become familiar with this new investigating and reporting system now

USABAAR NOW has a third generation computer system capable of recording and correlating more information about aircraft mishaps than any other system in existence. The benefits of this data management system to the Army aviation mishap prevention program are limitless and beyond comprehension—*providing those who investigate and supply information about mishaps furnish accurate and complete data about every mishap.*

To help you provide this data, a new DA Form 2397 series, consisting of 19 forms, has been designed. These forms request information about men, machines and environments involved in mishaps in a manner that allows you to simply check blocks or fill in blanks. In most cases, this will make it easier for you to record far more detailed information. The system is designed so that you only need to submit the forms that apply to problems which were found to have contributed, or were suspected of contributing, to mishaps.

This system has been thoroughly tested in USARV and in the aviation schools. Those participating reported much greater ease of handling with the new forms and the information provided by the forms was much superior to that provided by the previous 2397 series.

The new forms will come in manifolds of five copies, with guidelines on top for each manifold. The first copy of each form is a worksheet and it should be removed from the manifold prior to use to safeguard the remaining four copies which have interleaved carbons for ease of use.

In addition to accidents, the new reporting system requires you to investigate incidents, forced landings and precautionary landings. This will provide more valuable information to be used in the Army aviation mishap prevention program. For example, it can be used to find and replace defective parts.

Most major accidents will require only six to eight different types of forms. AR 95-5 prescribes the use of the necessary forms applicable to each mishap. The guidelines for completion of each form also establish criteria for its use.

An initial one-time supply of the new forms and regulations governing them (AR 95-5 and AR 385-40) is scheduled for distribution to the major commands 16 December 1970. Subordinate commands should receive distribution from the major commands (i.e., 7th Army should receive its supply from USAREUR). The effective date of the revised regulations governing use of the forms will be 1 January 1971. Thereafter, the regulations will be supplied through the normal TAG pinpoint distribution system. This means that if you have a current requisition for pinpoint distribution of the revised regulations, you will receive the new AR 95-5 and AR 385-40, plus future changes.

However, the new 2397 series reporting forms are another matter. DA forms are not provided under TAG pinpoint distribution and, after the initial one-time distribution to the major commands, must be requisitioned as they have in the past.

It is important to understand that a particular problem area may have contributed to a mishap, yet not be considered a cause factor. USABAAR is interested in obtaining information on all conditions present at the time of the mishap, whether they were considered to be a direct cause or not. If, for example, a crew member had been overworked and was in need of sleep, his condition may not have caused the mishap, but it may, in combination with other factors, have contributed to the cause of the mishap. The new forms have been designed so that you can record this information accurately to help obtain a much clearer idea of how similar mishaps may be prevented.

The efficiency of this new system lies entirely in the hands of those who investigate and report mishaps. Commanders must have mishap investi-

NEW AVIATION MISHAP REPORTING SYSTEM

gation boards appointed and well briefed on how to conduct investigations in accordance with AR 95-5 and AR 385-40 before mishaps occur. Safety officers at all levels should be well informed so they may intelligently council investigation boards and assure timely and accurate reporting. All aviators should become familiar with mishap investigation techniques so they may conduct efficient and accurate investigations when required.

In return for your cooperation, this new proven system will assure you of the best and safest equipment and procedures possible. It will assure the preservation of sorely needed Army aviation manpower and equipment resources. For your sake and the sake of those who depend on you to supply aviation support, become familiar with this new investigation and reporting system and put it to full use *now*.

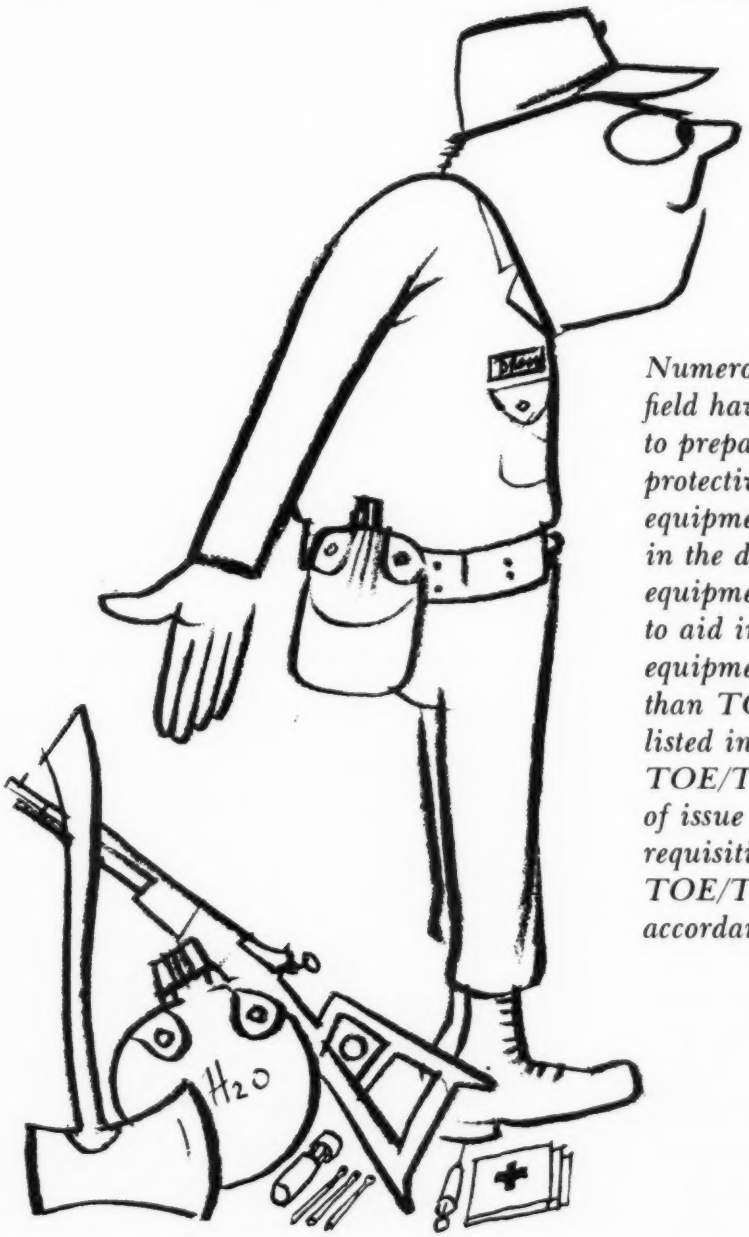
FORM NUMBER	TITLE	P/L	F/L	I	A
2397	Reviewing Official's Statement	N	N	N	Y
2397-1	Summary of Mishap	Y	Y	Y	Y
2397-2	Findings and Recommendations	Y	Y	Y	Y
2397-3	Narrative of Mishap	N	N	A/R	Y
2397-4	Witness Statements	N	N	A/R	Y
2397-5	Wreckage Distribution	N	N	A/R	Y
2397-6	Crash Survivability Report	N	N	N	A/R
2397-7 & 7A	Maintenance/Materiel Malfunction/Failure	A/R	Y	A/R	A/R
2397-8	Personal Data	N	N	Y	Y
2397-9	Psychophysiological and Environmental Factors	N	N	A/R	Y
2397-10	Personal/Protective Equipment	N	N	A/R	A/R
2397-11	Medical Information	A/R	A/R	A/R	A/R
2397-12	Emergency Evacuation	A/R	A/R	A/R	A/R
2397-13 & 13A	Ejection or Bailout	N	N	A/R	A/R
2397-14 & 14A	Survival and Rescue	A/R	A/R	A/R	A/R
2397-15	Fire Data	A/R	A/R	A/R	A/R
2397-16	Weather Data	A/R	A/R	A/R	Y
2397-17	Facilities	A/R	A/R	A/R	A/R
2397-18	Right Side Accident Folder Index	N	N	N	Y
2397-19	Left Side Accident Folder Index	N	N	N	Y

P/L - Precautionary Landing
F/L - Forced Landing
I - Incident
A - Accident

Y - Form will be required
N - Form is not required
A/R - Form will be submitted when the data listed on this form pertains to the mishap

PEARL'S

PERSONAL EQUIPMENT AND RESCUE/SURVIVAL LOWDOWN



Numerous inquiries from the field have prompted me to prepare a listing of personal, protective, rescue and survival equipment to be used as a guide in the determination of equipment authorization and to aid in procurement of desired equipment. Any authority other than TOE/TDA must be listed in Section I of the applicable TOE/TDA to be used as a basis of issue and authority to requisition. Changes to a TOE/TDA may be submitted in accordance with AR 310-49

PEARL'S personal equipment and rescue/survival lowdown

NOMENCLATURE		*FSN*	*AUTHORITY*
Armor Body Fragmentation Protective:			
For Groin	Size 28	8470-753-6110	CTA 50-901/2
	30	8470-753-6111	
	32	8470-753-6112	
	34	8470-753-6113	
	36	8470-753-6114	
	38	8470-753-6115	
	40	8470-753-6116	
	42	8470-753-6117	
Armor Body Fragmentation Protective: Neck Torso Nylon Titanium			
	Size Small	8470-965-4772	CTA 50-901/2
	Medium	8470-965-4773	
	Large	8470-965-4774	
Aural Protector Sound		4240-691-5617	SB 700-50
Bag Flying Helmet: Nvlon Outer Shell Lined with Polyester		8415-782-2989	CTA 50-901/2
Body Armor Aircrewman Fr-Bck Plates with Carrier: Small Arms Protective			
	Short	8470-935-3192	CTA 50-901/2
	Regular	8470-935-3193	
	Long	8470-935-3194	
Body Armor Aircrewman Front Plate with Carrier: Small Arms Protective			
	Short	8470-935-3183	CTA 50-901/2
	Regular	8470-935-3184	
	Long	8470-935-3185	
Case Ear Plug 12S		6515-299-8287	SB 8-100
Computer Air Navigation: Aluminum w/Case Type CPU 26A/P		6605-064-6911	SB 700-50 CTA 50-901/2
Coveralls, Flying Men's: Green Intermediate Weight, Type CWU-1/P			
	X-Large Long	8415-576-3399	CTA 50-901/2
	X-Large Short	8415-576-3400	
	X-Large Regular	8415-576-3401	
	Small Short	8415-576-3402	
	Large Short	8415-576-3403	
	Large Regular	8415-576-3404	
	Medium Short	8415-576-3405	
	Medium Regular	8415-576-3406	
	Medium Long	8415-576-3407	
	Small Long	8415-576-3408	
	Large Long	8415-576-3409	
	Small Regular	8415-576-3410	

NOMENCLATURE	*FSN*	*AUTHORITY*
First Aid Kit Airplane	6545-919-6650	SB 8-100
Glasses Sun: Man's Spectacle Type	8465-753-6261	CTA 50-901/2
Gloves Flyer's: Nylon Fire Retardant Type GS/FRP-1		
Size 7	8415-935-6328	CTA 50-901/2
8	8415-935-6329	
9	8415-935-6330	
10	8415-935-6331	
11	8415-935-6332	
Goggles, Sun, Wind and Dust, Single Aperture Two Plastic Lenses	8465-161-4068	CTA 50-901/2
Helmet Flyers:		
Crash Type Glass Outer Shell OG 106 (SPH-4)		
Regular	8415-144-4981	CTA 50-901/2
X-Large	8415-144-4985	
Jacket Flight Line Crmns: Nylon		
Small	8415-268-7773	CTA 50-901/2
Medium	8415-268-7774	
Large	8415-268-7775	
X-Large	8415-268-7776	
Jacket Flying Man's:		
Intermediate Wt Reversible Type MA1		
Medium	8415-818-7352	CTA 50-901/2
Large	8415-818-7353	
X-Large	8415-818-7354	
Small	8415-818-9133	
Summer Wt Reversible Type L-2B		
Large	8415-817-0595	
X-Large	8415-817-0596	
Small	8415-817-0597	
Medium	8415-817-0598	
Winter Wt Type N-2B		
Large	8415-270-0364	
X-Large	8415-270-0365	
Medium	8415-270-0366	
Small	8415-270-0367	
Winter Wt Type N-3B		
Small	8415-269-0418	
Medium	8415-269-0419	
Large	8415-269-0420	
X-Large	8415-269-0421	
Kit Bag Flyer's: Cotton Duck S.G.	8460-606-8366	CTA 50-901/2
Knife Hunting: 5-in. Blade 9½ in. O/A	7340-098-4327	CTA 50-901/2
Knife Pocket: One 3¾" Lg Cutting Blade	5110-526-8740	SB 700-50 CTA 50-901/2

PEARL'S personal equipment and rescue/survival lowdown

NOMENCLATURE		*FSN*	*AUTHORITY*
Life Preserver: Aircraft Crew LPU-2P		4220-630-8714	CTA 50-901/2
Life Preserver: Parachutist		4220-657-2197	CTA 50-901/2
Mask CBR: Protective Aircraft M24			
	Medium	4240-776-4384	TOE - TDA
	Large	4240-808-8798	
	Small	4240-808-8799	
Mask Oxygen	Large	1660-809-0390	SB 700-50
	Medium	1660-809-0379	
	Small	1660-809-0391	
	Disposable	1660-902-5308	
Parachute Personnel Back: 28 ft Dia		1670-805-9036	CTA 50-901/2
Parachute Personnel Chest: 28 ft Dia		1670-883-8674	CTA 50-901/2
Plug Ear Noise Protection, 24s (V-51-R)			
	Small	6515-299-8290	SB 8-100
	Medium	6515-299-8289	
	Large	6515-299-8288	
Plug Ear Noise Protection, Cotton Impregnated, Disposable 100S		6515-721-9092	
Plug Ear Noise Protection, Triple Flange 24s (Plastic Sterilizable)			
	Regular	6515-082-2675	SB 8-100
	Small	6515-082-2676	
Radio Set:	AN/URC-10	5820-858-5721	TOE - TDA
	AN/URC-14	5820-752-5278	
Seat, Rescue Assembly: Forest Penetrating		4240-758-8536	TOE - TDA
Shirt Flying Man's: Hot Weather, Fire Resistant Polyamide OG 106			
	X-Small Short	8415-935-4891	CTA 50-901/2
	X-Small Regular	8415-935-4892	
	X-Small Long	8415-935-4893	
	Small Short	8415-935-4894	
	Small Regular	8415-935-4895	
	Small Long	8415-935-4896	
	Medium Short	8415-935-4897	
	Medium Regular	8415-935-4898	
	Medium Long	8415-935-4899	
	Large Short	8415-935-4900	
	Large Regular	8415-935-4901	
	Large Long	8415-935-6200	
	X-Large Short	8415-935-6201	
	X-Large Regular	8415-935-6202	
	X-Large Long	8415-935-6203	

NOMENCLATURE	*FSN*	*AUTHORITY*
Signal Kit Personnel (Red)	1370-921-6172	CTA 50-901/2
(Various Colors)	1370-926-9387	
Survival Kit Individual	6545-611-0978	SB 8-100
Survival Kit Individual, Hot and Wet Environment	6545-782-2821	SB 8-100
Survival Kit Individual:		
Cold Climate	8465-973-1862	CTA 50-901/2
Cold Climate for OV-1 Acft	8465-782-3003	
Hot Climate	8465-973-1861	
Hot Climate for OV-1 Acft	8465-965-4701	
Overwater	8465-973-1863	
Overwater for OV-1 Acft	8465-965-4702	
Tool Kit: Army Aircraft Crash Investigation	5180-903-1049	TOE - TDA
Trousers Flying Man's: Hot Weather Fire Resistant Polyamide OG 106		
X-Small Short	8415-935-4878	CTA 50-901/2
X-Small Regular	8415-935-4879	
X-Small Long	8415-935-4880	
Small Short	8415-935-4881	
Small Regular	8415-935-4882	
Small Long	8415-935-4883	
Medium Short	8415-935-4884	
Medium Regular	8415-935-4885	
Medium Long	8415-935-4887	
Large Short	8415-935-4888	
Large Long	8415-935-4889	
X-Large Regular	8415-935-4890	
X-Large Short	8415-935-6206	
X-Large Long	8415-935-6207	
Trousers Flying Man's: Sage Green Intermediate Weight		
42 x 30	8415-266-9890	CTA 50-901/2
40 x 30¼	8415-266-9891	
38 x 30½	8415-266-9892	
36 x 29¼	8415-266-9893	
34 x 29½	8415-266-9894	
32 x 28¼	8415-266-9895	
30 x 28½	8415-266-9896	
28 x 28¾	8415-266-9897	
Vest Survival SRU-21/P	8465-177-4819	Limited Procurement for SEA Only

Comments, questions and recommendations are welcome. A list of kits and components is being prepared for publication in a later issue. If there are other items of equipment that should be added, please drop me a line and let me know. I hope this list will prove to be of some value and convenience.

Pearl

USAASO Sez

The U. S. Army Aeronautical Service Office discusses

Two "almost" gear-up landings

Technical Bulletin changes

ATC standardization

Aircraft "SAVE" Accomplishments: Congratulations to Specialist 5 Joseph E. Barfield, 420-58-7409, and Specialist 4 Davis E. Cheek, 510-46-1373, air traffic controllers stationed at Cairns Army Airfield, Ft. Rucker, Ala. Their timely warnings to pilots of OV-1 Mohawk aircraft on 17 July 1970 and 31 July 1970, respectively, prevented these aircraft from landing with the gear up. The alert manner in which they operated in the local control position prevented possible serious injuries to personnel and thousands of dollars damage to expensive and complex aircraft. Their high degree of professionalism initiative and knowledge has brought credit upon themselves and the U. S. Army.

GCA Radar: Attention to GCA radar set owners! The AN/TPN-8, AN/TPN-18 and AN/FPN-40 radar set cyclic overhaul was covered by SB 11-464, dated 23 July 1964. SB 11-464 has been superseded by TB 750-252, dated 25 June 1970, titled Cyclic Overhaul of Selected Electronic Equipment.

Good News for Air Traffic Control and NAVAID Facilities: The Army has launched a program to standardize these facilities at fixed Army airfields and heliports. The standardization criteria has been established by publication of TB 95-1 in February 1970. The facility communications electronics equipment engineering and installation are going to be done by the U. S. Army Strategic Communications Command (USASTRATCOM). The major commands have overall program management responsibility for the airfields/heliports within command.

What does this mean to the Army aviator? Remember those times you've had trouble contacting the control tower because of radio communication problems? Standardization will reduce these problems through improved equipment installation techniques. NAVAID service will be improved in a like manner. The information systems for Army controllers will be improved so that they can keep you advised of the latest altimeter reading, wind data, weather and ATC clearance data. The airfield operation facilities will have standardized radio and telephone communications systems to expedite you on your flight.

For Army controllers, standard ATC facilities reduce the facility training load since equipment types and layout will be the same throughout the Army. Backup power and radio communications equipment is provided to keep you operating in event of radio or power failure.

This is a worldwide program. The USASTRATCOM preliminary engineering survey teams are active at Army airfields/heliports in Europe, the Pacific, CONUS and Alaska. The major commands are setting installation priorities and working on logistics planning. USAASO has established the standards for this program in TB 95-1 and stands ready to provide technical assistance on air traffic control systems. These first steps have been taken toward our primary goal, to provide the Army aviator with the best service we can give.

FATIGUE

HAS

AN

ON

- SAFETY
- MORALE
- PERFORMANCE

COCKPIT DISCOMFORT

POOR MAINTENANCE

UNNECESSARY MISSIONS

SELF-IMPOSED STRESSES

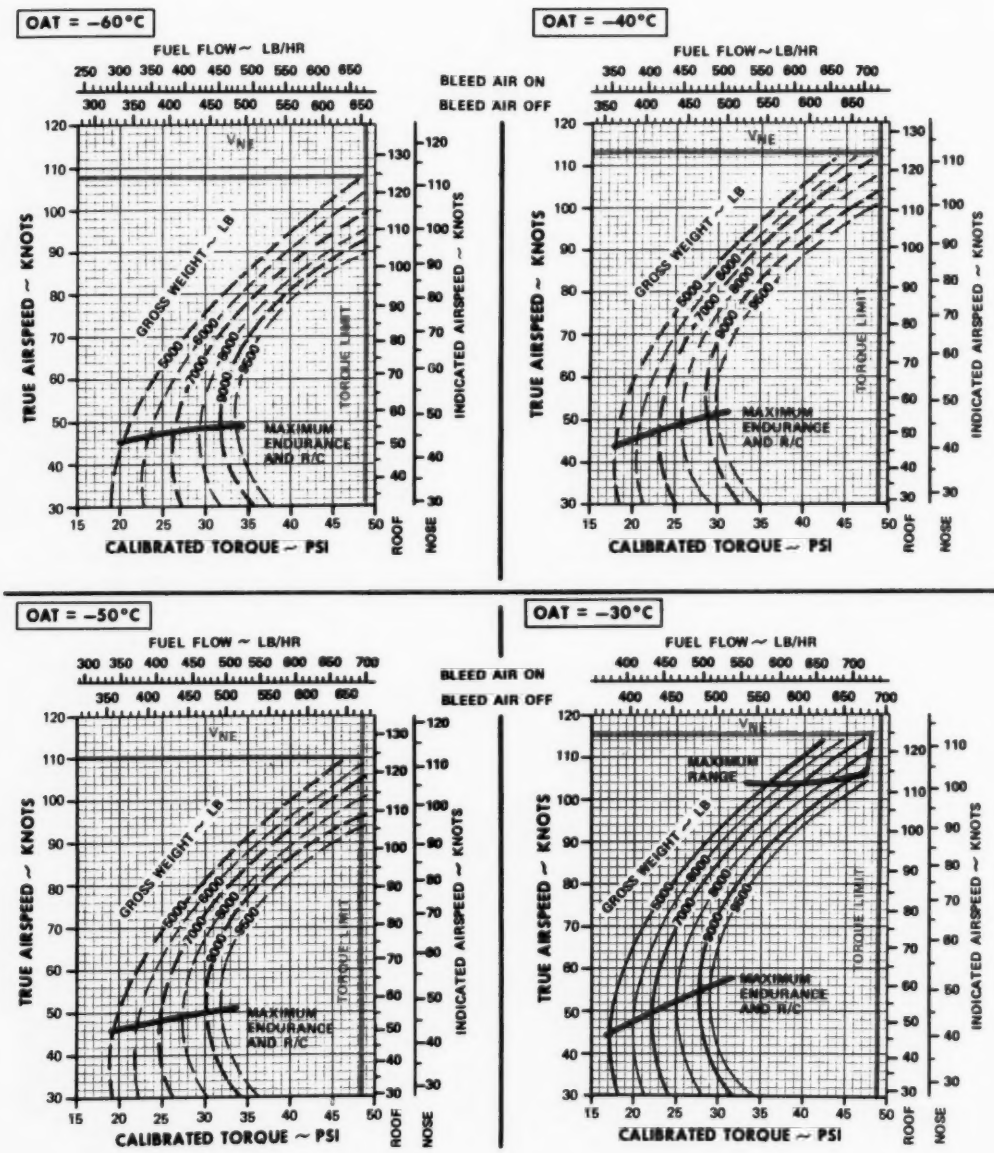
INADEQUATE AIRCRAFT DESIGN

EXCESSIVE FLYING HOURS

UNACCOUNTED HOURS WITH ENGINE TURNING OR STANDBY IN HOT AREAS

What are you doing about it?

Sponsored by the Society of U. S. Army Flight Surgeons


OAT = –60°C
FUEL FLOW ~ LB/HR
250 300 350 400 450 500 550 600 650
300 350 400 450 500 550 600 650
BLEED AIR ON
BLEED AIR OFF
V_{NE}
GROSS WEIGHT ~ LB
5000
6000
7000
8000
8500
9000
TORQUE LIMIT
MAXIMUM ENDURANCE AND R/C
TRUE AIRSPEED ~ KNOTS
INDICATED AIRSPEED ~ KNOTS
CALIBRATED TORQUE ~ PSI
ROOF
NOSE
OAT = –40°C
FUEL FLOW ~ LB/HR
350 400 450 500 550 600 650 700
350 400 450 500 550 600 650
OAT = –50°C
FUEL FLOW ~ LB/HR
300 350 400 450 500 550 600 650 700
350 400 450 500 550 600 650
OAT = –30°C
FUEL FLOW ~ LB/HR
400 450 500 550 600 650 700
MAXIMUM RANGE